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PRACTICAL MERCANTILE
ARITHMETIC,

IN WHICH THE THEORY AND PRACTICE OF ARITHMETIC ARE
FAMILIARLY EXPLAINED AND ILLUSTRATED,
BY A GREAT VARIETY OF
MERCANTILE, MECHANICAL, AND MATHEMATICAL
PROBLEMS.

SECOND EDITION.

REVISED, AND IMPROVED BY THE ADDITION OF

MENTAL EXERCISES.

BY LUTHER AINSWORTH.

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P R E F A C E .

IN offering to the public a second edition of his Arithmetic, the author gratefully acknowledges the favor of those who have encouraged the introduction and use of the first. He is happy to observe, that wherever it has been introduced and properly tested, it has been invariably approved. A proof of this is seen in the present demand for a second edition of the work, as no effort has been made, either by the author or publisher, to promote its introduction ; but it has been left to work its own way, and to stand or fall upon its own merit alone. The only objection, which the author has known to be urged against the first edition, was its want of examples for mental exercise. In this edition, it is believed, that deficiency is fully supplied, and in such systematic variety as will be both useful and interesting to the scholar, and satisfactory to the teacher. The work has, also, been carefully revised and corrected, some important additions have been made, and it is hoped that few errors will be found in it.

The plan and arrangement of this work are the result of no small experience both in business and teaching. Many years of active employment in mercantile transactions, and, subsequently, much experience in instruction, have given him abundant opportunity to learn the great deficiency in the education of young men, who had thought themselves prepared for stores and counting rooms, and for the transaction of business generally. In the treatise now offered to the public, the author *feels the fullest confidence* that a remedy for that *deficiency will be found, if a proper application of it is made in due*

During the many years the author has been engaged as a teacher, he has taken much pains to examine the Arithmetics in use in this part of the country. There is, in general, as he believes, a great want of system in their arrangement. The rules and illustrations, are, also, too abstruse and unintelligible for the understanding of young arithmeticians. There is, also, a general deficiency in their adaptation to those every-day practical, mercantile, and mechanical transactions, which are so necessary to qualify a young man for the various branches of business to which he may be called.

In pursuance of the object of improvement, the author has endeavored to follow a straight-forward, systematic course, from a beginning *sufficiently simple*, to combinations *sufficiently complicated*, to meet all the common exigencies of business. In those parts of the work which are more particularly applicable to business, the questions are, as far as possible, adapted to the actual every-day calculations that occur in mercantile and other business transactions.

The theory and principle upon which the various operations are founded, are, throughout the work, illustrated by plain, concise questions and answers, divested of all that unnecessary and extraneous matter, which abounds in many publications, and which is much better calculated to perplex than enlighten the mind of the pupil. The advantages of interrogative explanations, over all other methods, are too well known to the practical teacher to require any comment.

The limits of a Preface will not permit the author to specify all the parts, in which he flatters himself, improvements have been made. The practical utility of the work can best be learned, not from the arrangement and illustrations of the Rules alone, but from an examination of the examples in each rule, as leading the pupil to a practical application of his knowledge, adapted to actual business transactions. He would, however,

lead to some particular parts.

With ADDITION, it has been the object of the
to teach the pupil to add, but to put h

knowledge to a practical use ; as will be seen by a slight examination of the examples in that rule. Proceeding next to **SUBTRACTION**, the same knowledge of that rule is not only taught, but the pupil is required to combine, for practical purposes, both **Addition and Subtraction**. The same arrangement is pursued in **MULTIPLICATION**, and **DIVISION**. As soon as a competent knowledge of these rules is obtained, the pupil is required to combine the operation of all four, for familiar, practical purposes. And in all the succeeding rules throughout the work, the preceding ones are so combined, as to keep the thinking faculties of the pupil in constant exercise, and to render the practice of all the rules, as he progresses, familiar to his mind.

2. The **Addition and Subtraction Tables**, are on a new plan, and, it is believed, an improved one. The author has found the study of them, and their frequent rehearsal in his school, of particular advantage to young beginners.

3. The illustrations and examples given under Supplement to **Multiplication and Division**, in the application of fractional and mixed numbers, (no specific rules for which, are given in our common arithmetic,) will be found highly useful, especially to those who do not obtain a thorough knowledge of **Vulgar Fractions**.

4. To the illustrations and examples given in **Addition, Subtraction, Multiplication, and Division of Federal Money**, the knowledge of which, the author has ever found scholars, under the common course of instruction, extremely deficient.

5. To the rules and examples in **PRACTICE**, as adapted to **Federal Money**, and to practical and useful purposes.

6. To the several rules and examples in **INTEREST**, both **Simple**, and **Compound**, especially to the method of computing **Interest on Cash and Book Accounts**, which is so necessary for the accountant to understand, a knowledge of which, he has no means of obtaining from any arithmetic now in use.

7. To the illustrations and examples in **DUODECIMALS**, or **Cross Multiplication**, and their application to the measurement of wood, boards, timber, &c. a knowledge of which is so necessary, and so little understood.

8. To the measurement, and calculating the materials of Carpenters and Masons work, and also, the Mensuration of Superficies and Solids; the study of which will be found very interesting to scholars, and very useful in accustoming them to apply their knowledge of figures to the various practical and useful purposes of life.

This system has been tested in the author's own school, for the last five years, scarcely any other having been used, and he feels himself warranted in saying, that no scholars, at any time, under his instruction, have made equal proficiency in that branch of their studies, and with so little trouble to their teacher.

The work is again submitted to an enlightened public, with the fullest confidence that it will not be condemned unexamined, and with a cheerful hope, that upon a thorough examination, it will be found worthy of increased public patronage.

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ARITHMETICAL CHARACTERS.

1. This sign $=$ denotes equality ; as $1 \text{ lb.} = 16 \text{ oz.}$, or $\$1 = 100 \text{ cents.}$ That is, one pound is equal to 16 ounces, or 1 dollar is equal to 100 cents.

2. This sign $+$ denotes Addition or plus, as $5 + 4 = 9$. That is, 5 plus 4, or 5 added to 4, the sum is 9. This sign $+$ after an answer, also signifies a remainder.

3. This sign $-$ denotes Subtraction, or minus, as $18 - 6 = 12$. That is, 18, minus 6, or 18, 6 out, is equal to 12.

4. This sign $\times$ denotes Multiplication, as $5 \times 5 = 25$. That is, 5 multiplied by 5, the product is equal to 25.

5. This sign $\div$ denotes Division, as $36 \div 9 = 4$. That is, 36 divided by 9, the quotient is equal to 4.

6. Figures placed thus, $\frac{4}{9}$ denote that the upper number is to be divided by the lower.

7. Figures thus placed, $12 + 18 - 9 \times 6 \div 3 = 42$, may be read, 12 plus 18, minus 9, multiplied by 6, and divided by 3, the result is equal to 42.

8. These signs, $:$ $:$ $:$ denote proportion, as $4 : 16 :: 8 : 32$. That is, as 4 is to 16, so is 8 to 32.

9. This sign $\sqrt{}$ denotes that the square root is required.

10. This sign $\sqrt[3]{}$ denotes that the cube root is required.

11. This sign $\sqrt[4]{}$ denotes that the biquadrate root is required.

ARITHMETIC.

ARITHMETIC.

Q. What is Arithmetic ?

A. It is the art of computing by numbers, and consists both of Theory and Practice.

Q. What is to be understood by the Theory of Arithmetic ?

A. In Theory, it teaches the nature and power of numbers, and explains the reason and demonstrates the principle upon which practical operations are performed.

Q. What do you understand by Practical Arithmetic ?

A. It shows the shortest and plainest method of working questions, by numbers, so as to be most useful in business.

Q. Under how many fundamental rules, is Arithmetic comprised ?

A. Five, viz : Numeration, Addition, Subtraction, Multiplication, and Division.

Q. Are no more than these *five* rules necessary for a complete knowledge of Arithmetic ?

A. None. By a thorough understanding of the Theory of these, and a Practical knowledge of their application, the most difficult questions may be solved.

NUMERATION.

Q. What is numeration ?

A. It is the art of numbering, and teaches also to read, write, or express, any proposed number by figures.

Q. How many characters are used to denote numbers ?

A. Ten; nine of which, (viz: 1, 2, 3, 4, 5, 6, 7, 8, 9,) are called Figures or Digits: the other (0) is called a Cipher or Nought.

Q. Do figures always express the same value?

A. No. Figures have two values, one, termed simple, the other, local.

Q. When does a figure express its simple value?

A. When it stands alone: as 5, 7, 9, &c. Also when it stands in the first place or place of units, as 45. Here, the 5, expresses its simple value, or five ones.

Q. When does a figure express its local value?

A. When it stands in connexion with other figures, as 467. Here, the figures 4, and 6, express their local value, viz: 400, and 60.

Q. On what does the local value of a figure depend?

A. On the place it occupies from the units place.

Q. In what proportion do the figures increase from the right hand to the left?

A. In a *tenfold* proportion; that is, any figure in the first place or place of units, expresses so many ones; as 5, 6, &c. In the second place, or place of tens, it becomes so many tens, or ten times as much as in the first place; as 50, 60, &c. In the third place it becomes so many hundreds, or a hundred times as much as in the first place; as 500, 600, and so on, as may be seen in the Numeration Table.

Q. Of what value is a Cipher or Nought?

A. Of itself, it possesses no value, but being placed at the right hand of other figures, it increases *them* ten fold.

Q. If a cipher possess no value of itself, how can it increase the value of other figures?

A. By removing them one place farther from the units place, thus:

	(1)	(2)	(3)
4	40	400	4000 &c.

Q. How many ciphers must be annexed to figures to express even tens, even hundreds, even thousands, &c.?

A. To express tens, annex one cipher; for hundreds, annex two; for thousands, three; for tens of thousands, four; for hundreds of thousands, five; and for millions, six.

Q. At which hand do you begin and how do you numerate figures?

A. Begin at the right hand, and say, Units, Tens, Hundreds, Thousands, Tens of Thousands, &c. as in the Numeration Table.

NUMERATION TABLE.

3

NUMERATION TABLE.

9	8	7	6	5	4	3	2	1	0	1	2	987 thousand 654 millions 321012.
9	8	7	6	5	4	3	2	1	0	1	0	98 thousand 765 millions 432101.
9	8	7	6	5	4	3	2	1	0			9 thousand 876 millions 543210.
9	8	7	6	5	4	3	2	1				987 millions 654 thousand 321.
9	8	7	6	5	4	3	2					98 millions 765 thousand 432.
9	8	7	6	5	4	3						9 millions 876 thousand 543.
9	8	7	6	5	4							987 thousand 6 hundred 54.
9	8	7	6	5								98 thousand 7 hundred 65.
9	8	7	6									9 thousand 8 hundred 76.
9	8	7										9 hundred and 87.
9	8											Ninety-eight.
9												Nine.

The following arrangement may render the reading of figures more familiar to the learner.

Hundred.	9	8	7.	Hundred.	8	7	6.	Hundred.	6	5	4.	Hundred.	5	4	3.	Hundred.	3	2	1.	Hundred.	2	1	7.	Hundred.	1	6	4.
Trillions.				Thousands.				Billions.				Thousands.				Millions.				Thousands.				Tens.			
Units.				Tens.				Units.				Tens.				Units.				Tens.			Units.				
Hundreds.				Hundreds.				Hundreds.				Hundreds.				Hundreds.				Hundreds.			Hundreds.				

ADDITION.

EXAMPLES FOR EXERCISE.

Let scholars be required to read correctly, the following figures, expressing numbers :

No.	1	438	16	491,020,301
	2	604	17	300,000,001
	3	1,046	18	146,010
	4	5,609	19	4,607,183
	5	8,709	20	13,111,111
	6	91,063	21	90,901,909
	7	87,005	22	1,008
	8	40,910	23	13,131,131
	9	137,606	24	2,080,311
	10	49,004	25	123,456
	11	604,030	26	101
	12	340,102	27	3,902
	13	100,012	28	43,810
	14	8,406,874	29	376,010
	15	9,000,801	30	1,407,918

When the learner can read the foregoing numbers with facility, let him be required to write, in figures, the following numbers, viz.

Ninety-eight.

Nine hundred and thirty-seven.

Eight thousand, six hundred and fifty.

Seventy-five thousand, six hundred and four.

Eight hundred and twenty-four thousand, and seventy.

Four millions, seven hundred and fifty thousand and ten.

One million, no hundred and five thousand, no hundred and ten.

Two hundred and forty thousand, no hundred and seven.

Three millions, and forty thousand and nine.

Two hundred and seven millions, six hundred and seven thousand, nine hundred and eleven.

ADDITION.

Q. What is Addition ?

A. It is putting together several sums or numbers into one, so that the sum may be equal to the whole ; as 9, and 6, and 4,

kinds of Addition are there ?
and compound.

ADDITION TABLE.

5

Q. What is simple Addition ?

A. It is when the sums to be added, are all of one kind : that is, all dollars, all yards, all pounds, &c.

Q. When several sums are added together, what is the result called ?

A. The aggregate, the amount, or the sum total.

Q. What is the RULE for simple addition ?

A. Place the several sums, so that the first or right hand figure of each line, may stand directly under each other : that is, units under units, tens under tens, &c. and draw a line underneath. Begin at the right hand, and add all the figures in the unit's column, together, and if their sum amount to ten or more, set down the *right hand* figure under the column added, and carry the *left hand* figure or figures, to the next left hand column or row. Proceed in the same manner through every row to the last, and then set down the whole amount of that column.

Q. Why do you set down the right hand figure and carry the left ?

A. The right hand figure always possesses the same simple or local value as the column which is added, and must therefore be placed under it : the left hand figure shows how many *tens* are contained in the amount of the added column, and as the figures increase from the right hand to the left, in a ten-fold degree, all the *tens* contained in one column, must be added to the next, which will be carrying *one* for every *ten*.

Q. How can you prove addition ?

A. Begin at the top, and add the figures, (commencing with the units,) downwards, and if the *second* amount agree with the *first*, the work is supposed to be right.

ADDITION TABLE NO. 1.

2 and 1 are 3	3 and 1 are 4	4 and 1 are 5
and 2 are 5	and 2 are 6	and 2 are 7
and 3 are 8	and 3 are 9	and 3 are 10
and 4 are 12	and 4 are 13	and 4 are 14
and 5 are 17	and 5 are 18	and 5 are 19
and 6 are 23	and 6 are 24	and 6 are 25
and 7 are 30	and 7 are 31	and 7 are 32
and 8 are 38	and 8 are 39	and 8 are 40
and 9 are 47	and 9 are 48	and 9 are 49
and 10 are 57	and 10 are 58	and 10 are 59
and 11 are 68	and 11 are 69	and 11 are 70
and 12 are 80	and 12 are 81	and 12 are 82

A*

ADDITION TABLE.

5 and 1 are 6	6 and 1 are 7	7 and 1 are 8
and 2 are 8	and 2 are 9	and 2 are 10
and 3 are 11	and 3 are 12	and 3 are 13
and 4 are 15	and 4 are 16	and 4 are 17
and 5 are 20	and 5 are 21	and 5 are 22
and 6 are 26	and 6 are 27	and 6 are 28
and 7 are 33	and 7 are 34	and 7 are 35
and 8 are 41	and 8 are 42	and 8 are 43
and 9 are 50	and 9 are 51	and 9 are 52
and 10 are 60	and 10 are 61	and 10 are 62
and 11 are 71	and 11 are 72	and 11 are 73
and 12 are 83	and 12 are 84	and 12 are 85
8 and 1 are 9	9 and 1 are 10	10 and 1 are 11
and 2 are 11	and 2 are 12	and 2 are 13
and 3 are 14	and 3 are 15	and 3 are 16
and 4 are 18	and 4 are 19	and 4 are 20
and 5 are 23	and 5 are 24	and 5 are 25
and 6 are 29	and 6 are 30	and 6 are 31
and 7 are 36	and 7 are 37	and 7 are 38
and 8 are 44	and 8 are 45	and 8 are 46
and 9 are 53	and 9 are 54	and 9 are 55
and 10 are 63	and 10 are 64	and 10 are 65
and 11 are 74	and 11 are 75	and 11 are 76
and 12 are 86	and 12 are 87	and 12 are 88
11 and 1 are 12	12 and 1 are 13	13 and 1 are 14
and 2 are 14	and 2 are 15	and 2 are 16
and 3 are 17	and 3 are 18	and 3 are 19
and 4 are 21	and 4 are 22	and 4 are 23
and 5 are 26	and 5 are 27	and 5 are 28
and 6 are 32	and 6 are 33	and 6 are 34
and 7 are 39	and 7 are 40	and 7 are 41
and 8 are 47	and 8 are 48	and 8 are 49
and 9 are 56	and 9 are 57	and 9 are 58
and 10 are 66	and 10 are 67	and 10 are 68
and 11 are 77	and 11 are 78	and 11 are 79
and 12 are 89	and 12 are 90	and 12 are 91

These tables should be well studied by every scholar, before he commences his arithmetic, and frequently recited. Table No. 2, should sometimes be varied in the rehearsal, from the in which it is placed, as follows: 2 and 2 are 4, and 2 and 2 are 8, and 2 are 10, &c.; 3 and 3 are 6, and 3 are 12, and 3 are 15, &c.

ADDITION TABLE.

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ADDITION TABLE NO. II.

2 and 1 are 3	2 and 2 are 4	3 and 1 are 4
2 and 3 are 5	2 and 4 are 6	3 and 4 are 7
2 and 5 are 7	2 and 6 are 8	3 and 7 are 10
2 and 7 are 9	2 and 8 are 10	3 and 10 are 13
2 and 9 are 11	2 and 10 are 12	3 and 13 are 16
2 and 11 are 13	2 and 12 are 14	3 and 16 are 19
2 and 13 are 15	2 and 14 are 16	3 and 19 are 22
2 and 15 are 17	2 and 16 are 18	3 and 22 are 25
2 and 17 are 19	2 and 18 are 20	3 and 25 are 28
2 and 19 are 21	2 and 20 are 22	3 and 28 are 31
3 and 2 are 5	3 and 3 are 6	4 and 1 are 5
3 and 5 are 8	3 and 6 are 9	4 and 5 are 9
3 and 8 are 11	3 and 9 are 12	4 and 9 are 13
3 and 11 are 14	3 and 12 are 15	4 and 13 are 17
3 and 14 are 17	3 and 15 are 18	4 and 17 are 21
3 and 17 are 20	3 and 18 are 21	4 and 21 are 25
3 and 20 are 23	3 and 21 are 24	4 and 25 are 29
3 and 23 are 26	3 and 24 are 27	4 and 29 are 33
3 and 26 are 29	3 and 27 are 30	4 and 33 are 37
3 and 29 are 32	3 and 30 are 33	4 and 37 are 41
4 and 2 are 6	4 and 3 are 7	4 and 4 are 8
4 and 6 are 10	4 and 7 are 11	4 and 8 are 12
4 and 10 are 14	4 and 11 are 15	4 and 12 are 16
4 and 14 are 18	4 and 15 are 19	4 and 16 are 20
4 and 18 are 22	4 and 19 are 23	4 and 20 are 24
4 and 22 are 26	4 and 23 are 27	4 and 24 are 28
4 and 26 are 30	4 and 27 are 31	4 and 28 are 32
4 and 30 are 34	4 and 31 are 35	4 and 32 are 36
4 and 34 are 38	4 and 35 are 39	4 and 36 are 40
4 and 38 are 42	4 and 39 are 43	4 and 40 are 44
5 and 1 are 6	5 and 2 are 7	5 and 3 are 8
5 and 6 are 11	5 and 7 are 12	5 and 8 are 13
5 and 11 are 16	5 and 12 are 17	5 and 13 are 18
5 and 16 are 21	5 and 17 are 22	5 and 18 are 23
5 and 21 are 26	5 and 22 are 27	5 and 23 are 28
5 and 26 are 31	5 and 27 are 32	5 and 28 are 33
5 and 31 are 36	5 and 32 are 37	5 and 33 are 38
5 and 36 are 41	5 and 37 are 42	5 and 38 are 43
5 and 41 are 46	5 and 42 are 47	5 and 43 are 48
5 and 46 are 51	5 and 47 are 52	5 and 48 are 53

ADDITION TABLE.

5 and 4 are 9	5 and 5 are 10	6 and 1 are 7
5 and 9 are 14	5 and 10 are 15	6 and 7 are 13
5 and 14 are 19	5 and 15 are 20	6 and 13 are 19
5 and 19 are 24	5 and 20 are 25	6 and 19 are 25
5 and 24 are 29	5 and 25 are 30	6 and 25 are 31
5 and 29 are 34	5 and 30 are 35	6 and 31 are 37
5 and 34 are 39	5 and 35 are 40	6 and 37 are 43
5 and 39 are 44	5 and 40 are 45	6 and 43 are 49
5 and 44 are 49	5 and 45 are 50	6 and 49 are 55
5 and 49 are 54	5 and 50 are 55	6 and 55 are 61
6 and 2 are 8	6 and 3 are 9	6 and 4 are 10
6 and 8 are 14	6 and 9 are 15	6 and 10 are 16
6 and 14 are 20	6 and 15 are 21	6 and 16 are 22
6 and 20 are 26	6 and 21 are 27	6 and 22 are 28
6 and 26 are 32	6 and 27 are 33	6 and 28 are 34
6 and 32 are 38	6 and 33 are 39	6 and 34 are 40
6 and 38 are 44	6 and 39 are 45	6 and 40 are 46
6 and 44 are 50	6 and 45 are 51	6 and 46 are 52
6 and 50 are 56	6 and 51 are 57	6 and 52 are 58
6 and 56 are 62	6 and 57 are 63	6 and 58 are 64
6 and 5 are 11	6 and 6 are 12	7 and 1 are 8
6 and 11 are 17	6 and 12 are 18	7 and 8 are 15
6 and 17 are 23	6 and 18 are 24	7 and 15 are 22
6 and 23 are 29	6 and 24 are 30	7 and 22 are 29
6 and 29 are 35	6 and 30 are 36	7 and 29 are 36
6 and 35 are 41	6 and 36 are 42	7 and 36 are 43
6 and 41 are 47	6 and 42 are 48	7 and 43 are 50
6 and 47 are 53	6 and 48 are 54	7 and 50 are 57
6 and 53 are 59	6 and 54 are 60	7 and 57 are 64
6 and 59 are 65	6 and 60 are 66	7 and 64 are 71
7 and 2 are 9	7 and 3 are 10	7 and 4 are 11
7 and 9 are 16	7 and 10 are 17	7 and 11 are 18
7 and 16 are 23	7 and 17 are 24	7 and 18 are 25
7 and 23 are 30	7 and 24 are 31	7 and 25 are 32
7 and 30 are 37	7 and 31 are 38	7 and 32 are 39
7 and 37 are 44	7 and 38 are 45	7 and 39 are 46
7 and 44 are 51	7 and 45 are 52	7 and 46 are 53
7 and 51 are 58	7 and 52 are 59	7 and 53 are 60
7 and 58 are 65	7 and 59 are 66	7 and 60 are 67
7 and 65 are 72	7 and 66 are 73	7 and 67 are 74

ADDITION TABLE.

9

7 and 5 are 12	7 and 6 are 13	7 and 7 are 14
7 and 12 are 19	7 and 13 are 20	7 and 14 are 21
7 and 19 are 26	7 and 20 are 27	7 and 21 are 28
7 and 26 are 33	7 and 27 are 34	7 and 28 are 35
7 and 33 are 40	7 and 34 are 41	7 and 35 are 42
7 and 40 are 47	7 and 41 are 48	7 and 42 are 49
7 and 47 are 54	7 and 48 are 55	7 and 49 are 56
7 and 54 are 61	7 and 55 are 62	7 and 56 are 63
7 and 61 are 68	7 and 62 are 69	7 and 63 are 70
7 and 68 are 75	7 and 69 are 76	7 and 70 are 77

3 and 1 are 9	8 and 2 are 10	8 and 3 are 11
3 and 9 are 17	8 and 10 are 18	8 and 11 are 19
3 and 17 are 25	8 and 18 are 26	8 and 19 are 27
3 and 25 are 33	8 and 26 are 34	8 and 27 are 35
3 and 33 are 41	8 and 34 are 42	8 and 35 are 43
3 and 41 are 49	8 and 42 are 50	8 and 43 are 51
3 and 49 are 57	8 and 50 are 58	8 and 51 are 59
3 and 57 are 65	8 and 58 are 66	8 and 59 are 67
3 and 65 are 73	8 and 66 are 74	8 and 67 are 75
3 and 73 are 81	8 and 74 are 82	8 and 75 are 83

3 and 4 are 12	8 and 5 are 13	8 and 6 are 14
3 and 12 are 20	8 and 13 are 21	8 and 14 are 22
3 and 20 are 28	8 and 21 are 29	8 and 22 are 30
3 and 28 are 36	8 and 29 are 37	8 and 30 are 38
3 and 36 are 44	8 and 37 are 45	8 and 38 are 46
3 and 44 are 52	8 and 45 are 53	8 and 46 are 54
3 and 52 are 60	8 and 53 are 61	8 and 54 are 62
3 and 60 are 68	8 and 61 are 69	8 and 62 are 70
3 and 68 are 76	8 and 69 are 77	8 and 70 are 78
3 and 76 are 84	8 and 77 are 85	8 and 78 are 86

3 and 7 are 15	8 and 8 are 16	9 and 1 are 10
3 and 15 are 23	8 and 16 are 24	9 and 10 are 19
3 and 23 are 31	8 and 24 are 32	9 and 19 are 28
3 and 31 are 39	8 and 32 are 40	9 and 28 are 37
3 and 39 are 47	8 and 40 are 48	9 and 37 are 46
3 and 47 are 55	8 and 48 are 56	9 and 46 are 55
3 and 55 are 63	8 and 56 are 64	9 and 55 are 64
3 and 63 are 71	8 and 64 are 72	9 and 64 are 73
3 and 71 are 79	8 and 72 are 80	9 and 73 are 82
3 and 79 are 87	8 and 80 are 88	9 and 82 are 91

ADDITION TABLE

9 and 2 are	11	9 and 3 are	12	9 and 4 are	13
9 and 11 are	20	9 and 12 are	21	9 and 13 are	22
9 and 20 are	29	9 and 21 are	30	9 and 22 are	31
9 and 29 are	38	9 and 30 are	39	9 and 31 are	40
9 and 38 are	47	9 and 39 are	48	9 and 40 are	49
9 and 47 are	56	9 and 48 are	57	9 and 49 are	58
9 and 56 are	65	9 and 57 are	66	9 and 58 are	67
9 and 65 are	74	9 and 66 are	75	9 and 67 are	76
9 and 74 are	83	9 and 75 are	84	9 and 76 are	85
9 and 83 are	92	9 and 84 are	93	9 and 85 are	94

9 and 5 are	14	9 and 6 are	15	9 and 7 are	16
9 and 14 are	23	9 and 15 are	24	9 and 16 are	25
9 and 23 are	32	9 and 24 are	33	9 and 25 are	34
9 and 32 are	41	9 and 33 are	42	9 and 34 are	43
9 and 41 are	50	9 and 42 are	51	9 and 43 are	52
9 and 50 are	59	9 and 51 are	60	9 and 52 are	61
9 and 59 are	68	9 and 60 are	69	9 and 61 are	70
9 and 68 are	77	9 and 69 are	78	9 and 70 are	79
9 and 77 are	86	9 and 78 are	87	9 and 79 are	88
9 and 86 are	95	9 and 87 are	96	9 and 88 are	97

9 and 8 are	17	9 and 9 are	18	9 and 10 are	19
9 and 17 are	26	9 and 18 are	27	9 and 19 are	28
9 and 26 are	35	9 and 27 are	36	9 and 28 are	37
9 and 35 are	44	9 and 36 are	45	9 and 37 are	46
9 and 44 are	53	9 and 45 are	54	9 and 46 are	55
9 and 53 are	62	9 and 54 are	63	9 and 55 are	64
9 and 62 are	71	9 and 63 are	72	9 and 64 are	73
9 and 71 are	80	9 and 72 are	81	9 and 73 are	82
9 and 80 are	89	9 and 81 are	90	9 and 82 are	91
9 and 89 are	98	9 and 90 are	99	9 and 91 are	100

9 and 11 are	20	9 and 12 are	21	9 and 13 are	22
9 and 20 are	29	9 and 21 are	30	9 and 22 are	31
9 and 29 are	38	9 and 30 are	39	9 and 31 are	40
9 and 38 are	47	9 and 39 are	48	9 and 40 are	49
9 and 47 are	56	9 and 48 are	57	9 and 49 are	58
9 and 56 are	65	9 and 57 are	66	9 and 58 are	67
9 and 65 are	74	9 and 66 are	75	9 and 67 are	76
9 and 74 are	83	9 and 75 are	84	9 and 76 are	85
9 and 83 are	92	9 and 84 are	93	9 and 85 are	94
9 and 92 are	101	9 and 93 are	102	9 and 94 are	103

As facility in adding numbers is of the utmost importance in business, the teacher will consult the best interest of his scholars, especially those who are somewhat advanced in Arithmetic, by frequently exercising them, either singly or simultaneously in classes, in adding up the following rows of figures, until they can arrive at a correct result, with the utmost despatch.

1	3	2	1	1	9	2	7	4	9
2	2	3	2	3	8	9	8	2	3
3	1	2	3	2	7	3	5	8	7
1	4	4	4	5	6	8	3	6	4
3	3	2	5	4	5	4	2	3	6
4	1	5	6	6	4	7	9	7	8
1	5	2	7	5	3	5	6	1	2
4	4	7	8	7	2	6	5	9	5
5	1	2	9	6	1	3	4	5	8
1	6	8	8	8	1	9	3	7	7
5	5	2	7	7	2	4	1	9	1
6	1	9	6	9	3	8	2	3	9
1	7	3	5	8	4	5	7	6	2
6	6	2	4	6	5	7	9	4	5
7	1	3	3	7	6	3	6	1	3
1	8	4	2	5	7	8	4	8	7
7	7	3	1	6	8	4	1	7	9
8	1	5	2	4	9	7	3	5	6
1	9	3	3	5	8	5	2	9	4
8	8	6	4	3	7	9	7	2	8
9	1	3	5	4	6	4	6	6	7
1	10	7	6	2	5	8	4	3	9
9	9	3	7	3	4	3	2	5	3
10	1	8	8	1	3	7	1	8	5
104	104	98	116	117	123	138	107	128	137

EXAMPLES FOR MENTAL EXERCISE, SERIES I.

1. If you have 5 cents, and I give you 5 more, how many cents will you then have? How many are 5 and 5?
2. If you have 6 marbles in one pocket, and 6 in another, how many marbles have you in both?
3. If you pay 7 cents for nuts, and 4 for apples, how many cents do you pay away?
4. A boy bought a book for 8 cents, and a top for 7 cents; how many cents did he pay for both?
5. A man paid 9 dollars for a plough, and 6 dollars for a sled; how many dollars did he pay for both?

6. How many are 9 and 6? How many are 8 and 7?
7. John caught 11 fishes, and Charles caught 9; how many did both catch? How many are 11 and 9?
8. A merchant sold 12 barrels of flour to one man, and 6 barrels to another, how many did he sell to both?
9. On the 4th of July, George spent 8 cents, Henry spent 7 cents, and John 6 cents; how many cents did all three spend? How many are 8, 7 and 6?
10. John lost 9 marbles at play, and then had 9 left; how many had he at first? How many are 9 and 9?
11. A market woman sold her berries for 25 cents, and her eggs for 8 cents; how many cents did she get for both?
12. A merchant sold 15 barrels of flour, and had 9 barrels left; how many barrels had he at first?
13. A farmer bought a cow for 26 dollars, and sold her for 5 dollars more than he gave for her; how many dollars did he get for his cow?
14. If you buy a sled for 37 cents, and wish to make 8 cents by selling it, how much must you ask for your sled? How many are 37 and 8?
15. If you buy 16 marbles of Thomas, and 9 of John, how many marbles will you then have?
16. Julia had 13 cents, and her mother gave her 7 more; how many cents had she then?
17. How many are 7 and 8? 9 and 6? 12 and 9?

SECOND SERIES OF MENTAL EXAMPLES.

1. Eleven sheep were in a pasture, and 4 more were turned in with them; how many sheep in all?
2. If you pay 11 cents for a book, and 5 cents for quills, how many cents do you pay for both?
3. A boy found 6 cents, and his brother gave him 11 cents more; how many cents had he then?
4. A miller ground 11 bushels of rye, and 7 bushels of corn; how many bushels of both?
5. If I borrow 11 dollars from one man, and 9 dollars from another, how many dollars will pay them both?
6. There were 12 boys skating on a pond, and 4 boys were sliding; how many boys were on the pond?
7. If I pay 12 dollars for a cart, and 6 dollars for a plough, how much do I pay for both?
8. A butcher bought 13 fat sheep, and 6 lambs; how many
 " " How many are 13 and 7? 13 and 4? 13 and 5?
 13 cents in one pocket, and 8 cents in another;
 ? How many are 13 and 9? 13 and 10?

10. If 14 cows and 8 oxen are in one pasture, how many in all? How many are 14 and 8? 14 and 9?

11. A man bought a cow for 16 dollars and her calf for 5 dollars; how much for both?

12. A boy earned 17 cents, and found 6 cents; how many cents had he in all? How many are 17 and 8?

13. A man travelled 18 miles one day, and 9 miles the next; how many in all? How many are 18 and 8?

14. A young man entered college when he was 19 years old, and stayed 4 years; how old was he then?

15. A man earned 19 dollars, and a boy 7 dollars; how many dollars did both earn? How many are 19 and 8?

THIRD SERIES OF MENTAL EXAMPLES.

1. A boy in a store took 25 cents for 2 yards of cloth, and 8 cents for a piece of tape; how many did he take for both?

2. A farmer sold 27 bushels of corn, and 7 bushels of oats; how many bushels of both? How many are 26 and 5?

3. A school consists of 28 boys and 8 girls; how many scholars are there in the school?

4. John did 21 sums, and Charles did 9; how many did both do? How many are 84 and 6? 97 and 5? 95 and 8?

5. There were 34 ducks in a pond, and 8 more lit down with them; how many in all?

6. A man and his son went a fishing; the man caught 46, and his son 7; how many were caught by both?

7. A drover bought 57 lambs, and 8 old sheep; how many in all? How many are 21 and 5? 32 and 6?

8. If 65 scholars are in a school, and 9 more join it, how many scholars will there then be?

9. A man owed 78 dollars, and got trusted for 6 more; how much did he then owe? How many are 36, 9 and 5?

10. A boy spent 87 cents, and had 8 cents left; how many had he at first? How many are 75 and 7? 36 and 4?

11. John had 26 marbles, Thomas had 7, and Charles 6; how many had all 3? How many are 25 and 12?

12. A man had 36 cows, 7 steers, and 6 heifers; how many in all? How many are 43, 9 and 2? 19, 7 and 4?

13. If I pay 13 dollars for labor, 6 dollars for provisions, and 3 dollars for wood, how much do I pay for all?

14. A sportsman shot 23 plover, 8 quails, and 4 partridges; how many in all? How many are 33, 6 and 3?

15. How many are 6, 9 and 4? 8, 7 and 3? 11, 10 and 9? 13, 7 and 8? 14, 8 and 6? 21, 9 and 4? 37, 3 and 46, 3 and 1? 57, 4 and 9? 66, 3 and 11? 75, 5 and 1?

SIMPLE ADDITION.

FOURTH SERIES OF MENTAL EXAMPLES.

1. What is the amount of 2 tens? of 3 tens? of 4 tens? of 5 tens? of 6 tens? of 7 tens? of 8 tens? of 9 tens?
2. How much is any figure increased by having a figure placed at the right hand of it? A. 10 fold.
3. How many tens does the figure 5 represent when one figure stands at the right hand of it?
4. How many tens does 6 represent with one figure at the right hand? How many does 7? 8? 9?
5. What number does the figure 1 represent, with two figures at the right hand of it? The figure 2? 3? 4? &c.
6. John had 30 cents, and Henry had 40 cents; how many had both? A. 70 cents. Process.—30 is 3 tens, and 40 is 4 tens; then 3 tens and 4 tens are 7 tens; and 7 tens are the same as 70.
7. A man owed 50 dollars to A, and 40 to B; how many dollars will pay them both?
8. Eliza spent 60 cents for a book, and Jane 30 cents for quills; how many cents did both spend?
9. How many are 20 and 30? 20 and 40? 30 and 50? 50 and 20? 40 and 50? 60 and 40? 70 and 40? 80 and 30? 90 and 30? 80 and 60? 90 and 70?
10. How many are 20, 30 and 6? 30, 40 and 7.
11. A market woman sold her butter for 50 cents, her eggs for 40 cents, and a quart of berries for 8 cents; how many cents did she get for the whole?
12. James had 20 cents, Henry had 30, and John 40; how many cents had all three?
13. What sum will 40, 60 and 8 make added together?
14. How many are 70, and 20, and 6?
15. How many are 40, and 24, and 6?

EXAMPLES FOR EXERCISE ON THE SLATE, SERIES I.

(1)	(2)	(3)	(4)
Add 334	Add 324	Add 345	Add 446
212	432	453	564
123	243	534	645

(5)	(6)	(7)	(8)
Add 2134	Add 2345	Add 3456	Add 4547
1243	3424	6543	7546
	2453	4536	6474
	5342	5643	5764

9. A man bought a cow for 24 dollars, a horse for 46 dollars, and a yoke of oxen for 75 dollars; how many dollars did he give for the whole?

10. A boy bought a dozen of oranges for 25 cents, a pound of raisins for 18 cents, a gallon of molasses at 28 cents; how many cents did he give for the whole?

11. A man sold a cow for 16 dollars, a plough for 9 dollars, a cart for 25 dollars, and a hog for 12 dollars; what was the whole amount?

12. A boy spent 15 cents for candy, 16 cents for figs, 25 cents for a penknife, and 18 cents for a book; how many cents did he spend in all?

13. What is the amount of 36, 42, 31 and 77, added together?

14. If I buy a sled for 7 dollars, an axe for 3 dollars, a table for 8 dollars, and a bedstead for 13 dollars; what will the whole cost?

15. A sportsman killed 14 quails, 17 snipes, 8 partridges, and 17 plover; how many birds in all?

16. A man sold 14 acres of land to one farmer, 16 acres to another, and 24 acres each, to two more; how many acres did he sell?

17. A man owns four pastures. In the first are 35 sheep, in the second are 25 cows, in the third are 19 calves, and in the fourth are 12 horses; how many animals in all?

18. A man travelled 24 miles in one day, 18 miles in another, 27 miles in another, and 31 miles in another; how many miles did he travel in all?

19. A boy bought an arithmetic for 35 cents, a slate for 26 cents, a spelling book for 28 cents, and a writing book for 11 cents; how many cents did he pay for all?

20. Twenty-four hours make one day; how many hours are there in 5 days?

21. A house has 8 rooms on the lower floor, 9 in the second story, 11 in the third story, and 4 in the garret; how many rooms in the house?

22. A man owns 4 farms; the first one contains 134 acres, the second contains 175 acres, the third 211 acres, and the fourth 98 acres; how many acres of land does he own in all?

23. A rich farmer sold 213 bushels of corn, 375 bushels of rye, 137 bushels of wheat, and 186 bushels of oats; how many bushels of grain did he sell in all?

24. A merchant bought 4 pipes of wine, containing 128, 117 and 134 gallons; how many gallons in all?

25. What is the amount of 1237, 4183, 1984 and 9876, added together?

26. Add together 783, 1468, 64374 and 9046, and tell the amount?

27. A farmer bought 4 cows and paid 33 dollars for each; how much did he give for the four?

28. What is the total amount of 4400, 14000, 130300 and one million, added together?

29. A man divided his property equally among his 5 children, and gave to each 12867 dollars; what was the value of his whole estate?

30. Five men built a cotton factory, which cost them 14346 dollars each; what was the cost of the whole factory?

SERIES II.

(1)	(2)	(3)	(4)
Add 2375	Add 31246	Add 823567	Add 46732
1234	23465	146804	31894
3452	45783	407891	28906
4531	61047	683084	58732

(5)	(6)	(7)
Add 4670835	Add 82340678	Add 78945678
3783208	9324167	7894567
8976543	91247	789456
2345678	8123569	78945
9123456	82807	7894

8. Add together the following sums, viz. 49083: 5678393: 89346794: 408673: 8789634. *Ans.* 104272577

9. What is the amount of the following sums, viz. Seventy-five thousand six hundred and forty-three: Ninety-six thousand four hundred and eleven: Eight thousand six hundred and thirty: Four thousand and nine hundred: One hundred and seventy-two thousand six hundred and two? *Ans.* 358186.

10. If A owes me 146 dollars, B 237 dollars, C 354 dollars, and D 1324 dollars, how much do they all owe me?

Ans. 2061 dolls.

11. A merchant bought 5 hogsheads of coffee, weighing as follows, viz. No. 1, 783 lbs. No. 2, 864 lbs. No. 3, 1640 lbs. No. 4, 690 lbs. and No. 5, 568 lbs. how many pounds did he purchase in all?

Ans. 4545 lbs.

12. If 140 apples fill a peck measure, how many will fill a bushel measure?

Ans. 560.

13. If I set out on a journey, and travel 35 miles the first day, 45 miles the second, and continue to increase 10 miles each day, how many miles shall I be from home after traveling 5 days ?

Ans. 275.

14. There are 1760 yards in a mile ; how many yards will that boy travel who goes 2 miles and back again ?

Ans. 7040.

15. A farmer gave his son a peck of peaches to sell in market : the boy on counting them, found he had 145, and being very good ones, he sold them for one cent apiece ; his father finding he had done so well, gave him a bushel more, which he sold at the same rate ; can you tell how many cents the boy got for all his peaches ?

Ans. 725.

16. A gentleman purchased four sections of land : the first contained 5987 acres, the second, 7895, the third, 8957, and the fourth was to contain as many acres as all the three first added together ; how many acres did the fourth lot contain, and how many acres were bought in the whole ?

Ans. The fourth section contained 22839 acres, and he bought in all 45678 acres.

17. Five boys collected chesnuts : A found 4962, B 2346, C 5420, D 6201, and E as many again as A found ; how many chesnuts did they all get, and how many had E alone ?

Ans. They all got 28853, and E had for his part 9924.

18. A company of merchants fitted out four ships for India : The first ship cost 9875 dollars, and her cargo cost 25860 dollars : the second ship cost 19834 dollars, and her cargo 28987 dollars : the third ship cost 15900 dollars, and her cargo 30908 dollars : the fourth cost 25000 dollars, and her cargo 37800 dollars : now can you tell first, how much the ships cost ; then how much their cargoes cost ; and lastly, how much the ships and cargoes cost all put together ?

Ans. { The ships cost 70609 dollars ;
 { The cargoes cost 123555 dollars ;
 { Ships and cargoes together cost 194164 dollars.

19. A grocer in weighing off a quantity of cheese, weighed at the first draught, 30 cheeses, wt. 357 pounds : at the second draught, 28 cheeses, wt. 376 pounds : at the third, 35 cheeses, wt. 425 pounds : and at the fourth, 29 cheeses, wt. 394 pounds ; I wish to know how many cheeses the lot contained, and how many pounds they all weighed ?

Ans. 122 cheeses ; and all weighed 1552 pounds.

20. A teamer took on board his wagon 6 bales of cotton, wt. as follows : 360, 409, 390, 417, 376 and 425 lbs. besides 500 lbs. of iron ; tell me the weight of his load ?

Ans. 2877 lbs.

21. A merchant bought 5 kegs of butter, weighing keg and all as follows, viz. 57, 63, 71, 49, and 75 lbs. the kegs after taking out the butter weighed 15 lbs. each; how much did the whole weigh, and how much did the kegs weigh without the butter?

Ans. { The whole weighed 315 lbs.
The kegs weighed 75 lbs.

22. A gentleman bought a farm for \$2460, and built a house that cost him 1375 dollars, a barn that cost 750 dollars, and other out buildings, the cost of which was 385 dollars; his farming utensils cost 145 dollars, and he paid for repairing fences and building wall 136 dollars more; how much does his whole estate stand him in, and for how much must he sell it to gain 1000 dollars by his bargain?

Ans. { Estate stands him in \$5251.
He must sell it for \$6251.

23. A merchant purchased a vessel for \$7500, on board of which he put 475 dollars' worth of pork, 550 dollars' worth of beef, 385 dollars' worth of lard, 268 dollars' worth of butter, and 187 dollars' worth of cheese, besides hoops and staves to the amount of 235 dollars, and sent her to Havana, with orders for the captain to sell vessel and cargo together if he could get 2500 dollars more than their cost; what sum must he receive for the vessel and cargo?

Ans. \$12100.

24. A merchant hired a store and paid \$150 for one quarter's rent, in advance, and 225 dollars for fitting up the store. He then went to New-York, where he bought broadcloth to the amount of 2560 dollars, silks to the amount of 1375 dollars, satins amounting to 750 dollars, calicoes amounting to 987 dollars, and sundry other articles, which amounted to 2563 dollars; his expenses and the freight of the goods came to 75 dollars: what amount of money did he lay out in all, and how much must he sell the whole for in order to make by his purchases 1700 dollars?

Ans. { He laid out \$8685.
Must sell all for \$10385.

SUBTRACTION.

Q. What is subtraction?

A. It is taking a less number from a greater, and shows the difference between them: as 6 from 18 leaves 12, which is the difference between 6 and 18.

Q. How many kinds of subtraction are there?

Two: simple and compound.

What is simple subtraction?

A. It is when the given sums are all of one denomination, as all pounds, all yards, all dollars, &c.

Q. How many terms are always given in subtraction ?

A. Two are given, to find a third, which is the answer.

Q. How are these terms distinguished ?

A. The first, or larger number, is called the *minuend* : the second, or smaller number, is called the *subtrahend* : the third, or number sought, is called the *difference*, *answer*, or *remainder*, and shows how much the larger number exceeds the less.

Q. What is the *RULE* for simple subtraction ?

A. Place the less number under the greater, so that units may stand under units, tens under tens, &c. and draw a line under them : begin with the units, and take each figure in the lower line from the figure directly above it, and set down the remainder.

Q. If the lower figure be greater than the figure above it, how do you proceed ?

A. Subtract the lower figure from 10, and to this difference add the upper figure, and set down the amount underneath, and remember always after borrowing 10, to carry one to the next lower figure, before you subtract it : and so on to the last.

Q. How do you prove subtraction ?

A. Add the remainder and subtrahend together, and if the sum is right, the amount will be the same as the minuend.

SUBTRACTION TABLE.

2 from 13 leaves 11	3 from 7 leaves 4	5 from 19 leaves 14
2 from 11 leaves 9	3 from 4 leaves 1	5 from 14 leaves 9
2 from 9 leaves 7	3 from 12 leaves 9	5 from 9 leaves 4
2 from 7 leaves 5	3 from 9 leaves 6	5 from 18 leaves 13
2 from 5 leaves 3	3 from 6 leaves 3	5 from 13 leaves 8
2 from 3 leaves 1	3 from 3 leaves 0	5 from 8 leaves 3
2 from 12 leaves 10		5 from 17 leaves 12
2 from 10 leaves 8	4 from 15 leaves 11	5 from 12 leaves 7
2 from 8 leaves 6	4 from 11 leaves 7	5 from 7 leaves 2
2 from 6 leaves 4	4 from 7 leaves 3	5 from 16 leaves 11
2 from 4 leaves 2	4 from 14 leaves 10	5 from 11 leaves 6
2 from 2 leaves 0	4 from 10 leaves 6	5 from 6 leaves 1
	4 from 6 leaves 2	5 from 15 leaves 10
3 from 14 leaves 11	4 from 13 leaves 9	5 from 10 leaves 5
3 from 11 leaves 8	4 from 9 leaves 5	5 from 5 leaves 0
3 from 8 leaves 5	4 from 5 leaves 1	
3 from 5 leaves 2	4 from 12 leaves 8	6 from 23 leaves 17
3 from 13 leaves 10	4 from 8 leaves 4	6 from 17 leaves 11
3 from 10 leaves 7	4 from 4 leaves 0	6 from 11 leaves 5

6 from 22 leaves 16	8 from 13 leaves 5	10 from 29 leaves 19
6 from 16 leaves 10	8 from 28 leaves 20	10 from 19 leaves 9
6 from 10 leaves 4	8 from 20 leaves 12	10 from 38 leaves 28
6 from 21 leaves 15	8 from 12 leaves 4	10 from 28 leaves 18
6 from 15 leaves 9	8 from 27 leaves 19	10 from 18 leaves 8
6 from 9 leaves 3	8 from 19 leaves 11	10 from 37 leaves 27
6 from 20 leaves 14	8 from 11 leaves 3	10 from 27 leaves 17
6 from 14 leaves 8	8 from 26 leaves 18	10 from 17 leaves 7
6 from 8 leaves 2	8 from 18 leaves 10	10 from 36 leaves 26
6 from 19 leaves 13	8 from 10 leaves 2	10 from 26 leaves 16
6 from 13 leaves 7	8 from 25 leaves 17	10 from 16 leaves 6
6 from 7 leaves 1	8 from 17 leaves 9	10 from 35 leaves 25
6 from 18 leaves 12	8 from 9 leaves 1	10 from 25 leaves 15
6 from 12 leaves 6	8 from 24 leaves 16	10 from 15 leaves 5
6 from 6 leaves 0	8 from 16 leaves 8	10 from 34 leaves 24
	8 from 8 leaves 0	10 from 24 leaves 14
7 from 27 leaves 20		10 from 14 leaves 4
7 from 20 leaves 13	9 from 35 leaves 26	10 from 33 leaves 23
7 from 13 leaves 6	9 from 26 leaves 17	10 from 23 leaves 13
7 from 26 leaves 19	9 from 17 leaves 8	10 from 13 leaves 3
7 from 19 leaves 12	9 from 34 leaves 25	10 from 32 leaves 22
7 from 12 leaves 5	9 from 25 leaves 16	10 from 22 leaves 12
7 from 25 leaves 18	9 from 16 leaves 7	10 from 12 leaves 2
7 from 18 leaves 11	9 from 33 leaves 24	10 from 31 leaves 21
7 from 11 leaves 4	9 from 24 leaves 15	10 from 21 leaves 11
7 from 24 leaves 17	9 from 15 leaves 6	10 from 11 leaves 1
7 from 17 leaves 10	9 from 32 leaves 23	10 from 30 leaves 20
7 from 10 leaves 3	9 from 23 leaves 14	10 from 20 leaves 10
7 from 23 leaves 16	9 from 14 leaves 5	10 from 10 leaves 0
7 from 16 leaves 9	9 from 31 leaves 22	
7 from 9 leaves 2	9 from 22 leaves 13	11 from 43 leaves 32
7 from 22 leaves 15	9 from 13 leaves 4	11 from 32 leaves 21
7 from 15 leaves 8	9 from 30 leaves 21	11 from 21 leaves 10
7 from 8 leaves 1	9 from 21 leaves 12	11 from 42 leaves 31
7 from 21 leaves 14	9 from 12 leaves 3	11 from 31 leaves 20
7 from 14 leaves 7	9 from 29 leaves 20	11 from 20 leaves 9
7 from 7 leaves 0	9 from 20 leaves 11	11 from 41 leaves 30
	9 from 11 leaves 2	11 from 30 leaves 19
8 from 31 leaves 23	9 from 28 leaves 19	11 from 19 leaves 8
8 from 23 leaves 15	9 from 19 leaves 10	11 from 40 leaves 29
8 from 15 leaves 7	9 from 10 leaves 1	11 from 29 leaves 18
8 from 30 leaves 22	9 from 27 leaves 18	11 from 18 leaves
8 from 22 leaves 14	9 from 18 leaves 9	11 from 39 leaves 2
8 from 14 leaves 6	9 from 9 leaves 0	11 from 28 leaves 1
from 29 leaves 21		11 from 17 leaves
from 21 leaves 13	10 from 39 leaves 29	11 from 38 leaves

11 from 27 leaves 16 12 from 35 leaves 23 12 from 29 leaves 17
 11 from 16 leaves 5 12 from 23 leaves 11 12 from 17 leaves 5
 11 from 37 leaves 26 12 from 45 leaves 34 12 from 40 leaves 28
 11 from 26 leaves 15 12 from 34 leaves 22 12 from 25 leaves 13
 11 from 15 leaves 4 12 from 22 leaves 10 12 from 16 leaves 4
 11 from 36 leaves 25 12 from 45 leaves 33 12 from 39 leaves 27
 11 from 25 leaves 14 12 from 33 leaves 21 12 from 27 leaves 15
 11 from 14 leaves 3 12 from 21 leaves 9 12 from 15 leaves 3
 11 from 35 leaves 24 12 from 44 leaves 32 12 from 35 leaves 23
 11 from 24 leaves 13 12 from 32 leaves 20 12 from 26 leaves 14
 11 from 13 leaves 2 12 from 20 leaves 8 12 from 14 leaves 2
 11 from 34 leaves 23 12 from 43 leaves 31 12 from 37 leaves 25
 11 from 23 leaves 12 12 from 31 leaves 19 12 from 25 leaves 13
 11 from 12 leaves 1 12 from 19 leaves 7 12 from 13 leaves 1
 11 from 33 leaves 22 12 from 42 leaves 30 12 from 36 leaves 24
 11 from 22 leaves 11 12 from 30 leaves 18 12 from 24 leaves 12
 11 from 11 leaves 0 12 from 15 leaves 3 12 from 12 leaves 0
 12 from 47 leaves 35 12 from 41 leaves 29

This Table, together with the Addition Tables, may be thought too long and tedious for the memory of the scholars; but their time, it is believed, cannot be better employed than in studying them; as much time afterwards will be saved, and many mistakes prevented in their future progress. Even if they are not committed to memory, much advantage may be derived from a frequent simultaneous rehearsal, by all those who are capable of reading figures. They will thus acquire a facility in adding and subtracting, which will last them through life.

EXAMPLES FOR MENTAL EXERCISE, SERIES I.

1. A boy had 9 cents, and spent 3; how many had he left?
2. A man had 8 cows, and sold 4; how many had he left?
3. A boy bought 12 marbles, and lost 5 at play; how many had he left?
4. A merchant bought 11 barrels of flour, and sold 6 of them; how many were left unsold?
5. A boy carried 14 chickens to market, and sold all but 5; how many did he sell?
6. A sportsman shot 16 birds, and gave away 9; how many were left?
7. A. bought goods in a store to the amount of 9 dollars, and gave the shop-keeper a 20 dollar bill; how many dollars had he to receive in change?
8. If a man have 18 sheep, and sell 13, how many has he left?
9. If I owe 13 dollars and pay 6 of them, how much do I then owe?

10. A boy found 19 chestnuts, and gave his sister 9 of them; how many had he left?

11. A man bought 17 acres of land, and sold 8 acres of it; how many were left?

12. If 8 yards be cut from a piece of cloth, containing 14 yards, how many yards will remain?

13. A boy sold a knife for 17 cents, and made 6 cents by his bargain; how much did it cost him?

14. A man bought a cow for 18 dollars, and lost 4 dollars by selling her; how many dollars did he sell her for?

15. If you take 3 from 8, how many will remain? 4 from 9, how many? 5 from 11? 6 from 13? 7 from 15? 8 from 17? 9 from 20? 11 from 18? 12 from 17? 9 from 16? 6 from 14? 10 from 15? 13 from 18? 12 from 19? 7 from 16?

SECOND SERIES OF MENTAL EXAMPLES.

1. A boy had 12 cents, and spent 3 for candy and 4 for nuts; how many had he left?

2. A man had 13 fat sheep, and sold to one drover 4 and to another 5; how many had he left?

3. A merchant bought 17 barrels of flour, and sold 6 to one man, 7 to another, and the residue to a third; how many barrels did the third man buy?

4. A boy found 20 chestnuts, and gave his brother 5, his sister 6, and his mother 4; how many did he have for himself?

5. John had 19 cents, and spent 6 for apples and 5 for peaches; how many were left?

6. George and James had each 20 marbles, but in playing together, James won so many as to make his number 26; how many had George then left?

7. A farmer had 25 bushels of corn, and sold 13; how many were left?

8. A man bought a watch for 28 dollars, but in selling it, he lost 9 dollars; how much did he get for the watch?

9. A man sold a horse for 37 dollars, which was 9 dollars more than the cost of him; how much did the horse cost?

10. Edward's father gave him 25 cents; he laid out 11 cents for a writing-book, and 5 cents for quills; how many cents had he left?

11. A boy had 27 peaches, and sold 6 to Henry and 11 to James; how many had he left?

12. If 3 and 5 are taken out of 11, how many remain? 4 and 7 out of 15? 7 and 6 out of 19? 5 and 9 out of 18? 6 and 11 out of 20? 8 and 7 out of 19? 11 from 17? 16 from 26? 19 from 28? 17 from 24? 3 and 2 out of 9? 4 and 3 out of 12?

SIMPLE SUBTRACTION.

23

5 and 1 out of 13? 6 and 10 out of 19? 21 and 6 out of 30?
18 and 6 out of 27? 14 and 4 out of 20? 13 and 7 out of 25?

THIRD SERIES OF MENTAL EXAMPLES.

1. A man had 60 dollars, and paid away 30; how many dollars had he left?

Process. 60 is 6 tens, and 30 is 3 tens; then 3 tens from 6 tens, leave 3 tens, and 3 tens are 30, the answer.

2. John had 70 cents, and spent 40; how many were left?

3. A man had 80 sheep in his flock, and sold all but 30 of them; how many did he sell?

4. A merchant bought 100 bags of coffee, and sold 60 bags of it; how many remained unsold?

5. John's father gave him 40 cents, and his mother gave him 30 more; out of which he bought a book for 50 cents; how many cents had he left?

6. A man set out on a journey of 100 miles, and travelled 30 miles the first day, and 40 miles the second; how many miles must he travel on the third day to complete his journey?

7. If I buy 70 acres of land of one man, and 40 acres of another, how many acres do I buy in all?

8. And how many shall I have left, if I sell 80 acres?

9. A merchant bought 25 barrels of flour of one man, and 60 barrels of another, and sold 30 barrels; how many barrels were left unsold?

10. If I have 100 dollars, and buy a horse for 30 dollars, and a cow for 20 dollars, how many dollars have I left?

11. John had 80 cents, and bought a book for 40 cents, and a slate for 20 cents; how many were left?

12. Add 40 and 60 together, and take 70 out of the same, and how many remain?

13. If you take 40 out of 20 and 30, how many remain?

14. Take 60 out of 40 and 50, how many remain?

15. 70 out of 60 and 40? 50 out of 20 and 70?

16. 20 out of 10 and 40? 30 out of 40 and 40?

FOURTH SERIES OF MENTAL EXAMPLES.

1. A butcher bought 19 sheep of one man, and 20 of another; how many did he buy?

2. If a man have 49 sheep, and sell 30 of them, how many remain?

3. A man bought a horse for 34 dollars, but the horse proving lame, he sold him for 14 dollars less than he gave; how many dollars did he sell him for?

4. John caught 13 fishes, and Henry caught 9; how many must John give to Henry to make their number equal?

5. Jane found 40 chesnuts, and Julia found 20; but Jane gave to Julia so many as made their number equal; how many did Jane give to Julia, and how many had each them?

6. George gave 25 cents for a penknife, and sold it for 8 cents profit; how many cents did he get for it?

7. If I sell a cow for 24 dollars, and make 6 dollars by my bargain, how much did she cost me?

8. If 30, 40 and 20 be added together, and 50 subtracted, what will be the remainder?

9. James had 62 cents, and bought a book for 15 cents, and a knife for 25 cents; how many cents had he left?

10. A man bought a horse for 50 dollars, and gave in exchange 20 sheep, at one and half a dollar a head, and the balance in money; how many dollars did he pay?

11. A merchant bought a chest of tea for 56 dollars, and paid for carting it from Boston, 3 dollars; how much must he sell it for to make 5 dollars by the sale?

12. John has 60 cents, and Mary has 40; how many cents must John give to Mary, that she may have 10 cents more than John?

13. A market girl sold her butter for 30 cents, her berries for 15 cents, and her eggs for 20 cents, and bought 3 pounds of sugar for 50 cents; how many cents had she left?

14. A boy sold a penknife for 25 cents, which was 5 cents less than the cost, when he ought to have made 6 cents by his bargain? how much did he sell it under its true value?

15. Thomas and Henry played at marbles; Thomas had 24, and Henry had 16, but Henry won 12 of Thomas; how many had each then?

16. A tailor bought a piece of cloth, containing 40 yards; after making a suit of clothes that required 11 yards, and selling 9 yards more, how many yards were left?

17. Bought a chest of tea for 34 dollars, but it being not so good as was recommended, I am allowed 6 dollars deduction; what did I pay for it, and for what must I sell it to gain 5 dollars by my bargain?

18. If 9 and 12 be added together, and 11 taken from the sum, what will remain?

19. If 13 be taken from 26, and 9 added to the remainder, what will the sum be?

20. William had 70 cents, but having a hole in his pocket, lost 40 of them, his father gave him so many more that he had 80 cents; how many did his father give him?

21. Robert stole 36 peaches, and meeting 3 boys, and fearing they would expose him, he gave to one 9, to another 6, and to the other, 5; how many had he still left?

22. A boy had 40 cents, and lost all but 15; how many did he lose? How many are 9 and 8, with 7 out? 11 and 8, with 9 out? 12 and 12, with 13 out? 25 and 30, with 40 out? 40 and 60, with 70 out? 60 and 20, with 50 out? 9 and 8 and 7, with 12 out? 7 and 10 and 5, with 11 out? 9 and 8 and 7 and 6, with 13 out?

EXAMPLES FOR EXERCISE ON THE SLATE, SERIES I.

(1)	(2)	(3)	(4)	(5)
From 25	From 23	From 36	From 37	From 42
Take 13	Take 14	Take 18	Take 28	Take 26
—	—	—	—	—

(6)	(7)	(8)	(9)	(10)
From 125	From 241	From 237	From 260	From 531
Take 47	Take 73	Take 148	Take 163	Take 456
—	—	—	—	—

(11)	(12)	(13)	(14)
From 207	From 140	From 304	From 417
Take 79	Take 35	Take 109	Take 309
—	—	—	—

15. A boy had 37 cents, and spent 18, how many had he left?

16. A boy sold his apples for 50 cents, and his chesnuts for 25 cents, and bought a gallon of molasses for 35 cents; how much money had he left?

17. If you have 80 cents, and buy a book for 18 cents, a slate for 25 cents, and a bunch of quills for 14 cents, how many cents have you left?

18. A man had 140 sheep, and sold 75 of them; how many had he left?

19. A merchant bought 150 barrels of flour, and sold at one time 25, at another 47; how many had he left?

20. A man drew 240 dollars in a lottery, and purchased a horse for 32 dollars, a cow for 26 dollars, and a barrel of pork for 16 dollars; how many dollars did he have remaining?

21. A man raised 164 bushels of corn, and sold 115 bushels; how many bushels had he left?

22. If you sell 25 yards from a piece of cloth containing 63 yards, how many yards will remain?

23. A grocer bought a cask of wine containing 133 gallons, and sold to one man 36 gallons, to another 28 gallons, and 15 gallons for himself; how many has he left to sell?

24. Charles had 3 dozen oranges, and sold 8 to John, 13 to Henry, and 9 to Thomas; how many had Charles left unsold?

SERIES II.

(1)
From 34765
Take 12352

Rem. 22413

Proof 34765

(2)
From 468573
Take 43052

Rem. 425521

Proof 468573

(3)
From 9126746
Take 3014320

(4)
From 43782
Take 21892

(5)
From 7357456
Take 3573260

(6)
From 2461234
Take 1065236

(7)
From 1230456789
Take 897614327

(8)
From 307684132
Take 13955436

(9)
From 213564
Take 166555

(10)
From 100200300400500
Take 980653576642

(11)
From 980870760650
Take 345486923215

12. A gentleman drew a prize of 5760 dollars, out of which he paid his debts, amounting to 3971 dollars; what had he left?
Ans. 1789 dolls.

13. A banker had 5 bags of dollars, containing in all, 6325 dollars; a thief stole 3 bags, each containing 1233 dollars: I want to know how many were stolen, and how many left?

Ans. 3699 stolen; 2626 left.

14. What sum being added to 450000, will make a million?

Ans.

15. A merchant purchased 3 pipes of wine for 450 dollars, paid 30 dollars for freight, and for other expenses 9 dollars; he afterwards sold them for 175 dollars a pipe; did he gain or lose by the bargain, and how much?

Ans. gained 36 dolls.

16. What is the difference between 3 times 4783, and 3 times 3874?

Ans. 2727.

17. A grocer bought 150 cheeses, weighing 2450 lbs. and he sold 84 of them, which weighed 1460 lbs.; how many cheeses did he have left, and how much did they weigh?

Ans. 66 left, and they weighed 990 lbs.

18. I borrowed of my friend at one time, 4687 dollars; at another time, 1960 dollars; and paid him 3987 dollars; can you tell how much I still owe him? *Ans.* 2660 dolls.

19. A merchant bought 3 packages of cloth, each containing 375 yards. After selling to one man 450 yards, and to another 387 yards, he wishes to know how many yards are left. See if you can tell him. *Ans.* 288 yards.

20. A merchant bought 5 kegs of butter, weighing, kegs and all, as follows: 57, 63, 71, 69 and 73; the kegs weighed 13 pounds each; how many pounds of butter were there, after deducting the weight of the firkins? *Ans.* 208 lbs.

21. The United States declared themselves independent July 4th, 1776; how many years is it since the declaration? *Ans.*

22. Christopher Columbus discovered America in 1492; how many years have passed since that time? *Ans.*

23. Suppose your age to be 13 years; in what year were you born? *Ans.*

24. If your father were born in 1789, and yourself in 1812, can you tell me your own, and your father's age at this time, 1837; and also how much older your father is, than yourself?

Ans. { My father's age is 48 years.
My own age is 25 years.
My father is 23 years older than I am.

25. A gentleman bought a township of land containing 27960 acres for 25000 dollars; he afterwards sold 9860 acres for 10000 dollars, and wished to keep 1000 acres for himself, and sell the residue for enough to pay the balance of his purchase; he did so; now how much did he sell, and how much did the land come to?

Ans. { He sold, as the residue, 17100 acres,
which came to 15000 dollars.

26. An India ship took on board 15000 chests of tea; a heavy gale coming on, the captain was compelled to throw 875 chests overboard; soon after, the ship sprung a leak, and 1560 chests more were cast over; can you tell how many chests were thrown over in all, and how many were left in the ship?

Ans. { 2435 thrown over;
12565 left in the ship.

27. A farmer sent 5 loads of hay to market, that weighed in all 114 cwt.; the wagons weighed 5 cwt. each; how many hundred weight of hay were in the 5 wagons. *Ans.*

28. A post-office received in one year, 976450 letters; of these 17640 were double; how many were single? *Ans.*

29. A fisherman in drawing his seine caught 14763 of 9375 of which were herring, and the rest menhaden; how more herring than menhaden were in the net? *Ans.*

SIMPLE MULTIPLICATION.

5 times 0 are	0	6 times 0 are	0	7 times 0 are	
5 times 1 are	5	6 times 1 are	6	7 times 1 are	1
5 times 2 are	10	6 times 2 are	12	7 times 2 are	2
5 times 3 are	15	6 times 3 are	18	7 times 3 are	3
5 times 4 are	20	6 times 4 are	24	7 times 4 are	4
5 times 5 are	25	6 times 5 are	30	7 times 5 are	5
5 times 6 are	30	6 times 6 are	36	7 times 6 are	6
5 times 7 are	35	6 times 7 are	42	7 times 7 are	7
5 times 8 are	40	6 times 8 are	48	7 times 8 are	8
5 times 9 are	45	6 times 9 are	54	7 times 9 are	9
5 times 10 are	50	6 times 10 are	60	7 times 10 are	10
5 times 11 are	55	6 times 11 are	66	7 times 11 are	11
5 times 12 are	60	6 times 12 are	72	7 times 12 are	12

8 times 0 are	0	9 times 0 are	0	10 times 0 are	
8 times 1 are	8	9 times 1 are	9	10 times 1 are	1
8 times 2 are	16	9 times 2 are	18	10 times 2 are	2
8 times 3 are	24	9 times 3 are	27	10 times 3 are	3
8 times 4 are	32	9 times 4 are	36	10 times 4 are	4
8 times 5 are	40	9 times 5 are	45	10 times 5 are	5
8 times 6 are	48	9 times 6 are	54	10 times 6 are	6
8 times 7 are	56	9 times 7 are	63	10 times 7 are	7
8 times 8 are	64	9 times 8 are	72	10 times 8 are	8
8 times 9 are	72	9 times 9 are	81	10 times 9 are	9
8 times 10 are	80	9 times 10 are	90	10 times 10 are	10
8 times 11 are	88	9 times 11 are	99	10 times 11 are	11
8 times 12 are	96	9 times 12 are	108	10 times 12 are	12

11 times 0 are	0	12 times 0 are	0	13 times 0 are	
11 times 1 are	11	12 times 1 are	12	13 times 1 are	1
11 times 2 are	22	12 times 2 are	24	13 times 2 are	2
11 times 3 are	33	12 times 3 are	36	13 times 3 are	3
11 times 4 are	44	12 times 4 are	48	13 times 4 are	4
11 times 5 are	55	12 times 5 are	60	13 times 5 are	5
11 times 6 are	66	12 times 6 are	72	13 times 6 are	6
11 times 7 are	77	12 times 7 are	84	13 times 7 are	7
11 times 8 are	88	12 times 8 are	96	13 times 8 are	8
11 times 9 are	99	12 times 9 are	108	13 times 9 are	9
11 times 10 are	110	12 times 10 are	120	13 times 10 are	10
11 times 11 are	121	12 times 11 are	132	13 times 11 are	11
11 times 12 are	132	12 times 12 are	144	13 times 12 are	12

EXAMPLES FOR MENTAL EXERCISE, SERIES I.

1. Four boys had 6 cents each; how many had the 4?
 If one yard of cloth cost 5 dollars, what will 9 yards cost?
 If a man earn 8 cents in an hour, how many can
 earn many in 9 hours?

4. If a man's wages be 9 dollars a month, what must I pay him for 12 months?
5. Four quarts make a gallon; how many quarts in 11 gallons? How many in 9 gallons? In 7 gallons?
6. Six shillings make a dollar; how many in 9 dollars?
7. Four pecks make a bushel; how many pecks in a bin that holds 8 bushels? 11 bushels? 9 bushels?
8. A boy sold 9 quarts of cherries at 12 cents a quart; what was the amount?
9. A boy in a shop, sold 7 dozens of buttons at 9 cents a dozen; what was the amount?
10. A man sold 12 sheep, at 5 dollars a head; how much did they amount to?
11. What cost a piece of cloth containing 9 yards, at 8 dollars the yard?
12. Four boys caught each 11 fishes, but lost 5 each before they got home; how many had they left?
13. James picked 4 quarts of berries, and Edward picked five quarts; they sold them together at 7 cents a quart; how many cents did they get for their berries?
14. A man sold 7 sheep for 4 dollars a head; and 6 lambs for 3 dollars a head; how much more did he get for the sheep, than for the lambs?
15. what must I give for 7 cords of wood at 6 dollars the cord?
16. How many are 4 times 12? 5 times 6? 6 times 8? 7 times 9? 9 times 11? 12 times 8? 12 times 6? 8 times 9? 7 times 6? 9 times 6? 8 times 6? 11 times 9? 11 times 11? 11 times 12? 9 times 7? 12 times 7?

SECOND SERIES OF MENTAL EXAMPLES.

1. If I sell 8 barrels of flour at 6 dollars a barrel, and pay away 20 dollars of the money, how many shall I have left?
2. John sold 9 quarts of cherries for 6 cents a quart, and bought a book for 25 cents; how many cents were left?
3. A market man sold his eggs for 60 cents, and his apples for 40 cents, and bought 8 pounds of cheese at 11 cents a pound; how many cents were left?
4. A man sold 12 sheep at 5 dollars a head, and bought a horse for 45 dollars; how much was left?
5. If I owe 100 dollars, and sell 9 barrels of flour at 5 dollars a barrel, how many dollars must I borrow to make up the sum?
6. James owed Charles 50 cents, and sold 3 dozen of eggs at 12 cents a dozen; how many cents will make up the sum?

7. Henry sold 12 quarts of cherries at 7 cents a quart, and his father gave him 16 cents more; how many cents had he then?

8. Mr. A. gave little Edward 8 cents a day, for three days, for being a good boy, and on the fourth day he gave him 12 cents; how many cents had he in all?

9. A merchant bought 7 barrels of flour of one man, and 5 barrels of another, and sold the whole at 7 dollars a barrel; what was the amount?

10. If I buy 12 barrels of flour at 7 dollars a barrel, what must I get for the whole, to make 12 dollars by the bargain?

11. A man bought 12 fat sheep at 4 dollars a head, and sold the whole for 45 dollars; did he gain or lose, and how much?

12. If I buy 9 yards of cloth at 6 dollars the yard, what must I get for the whole, to make one dollar on each yard?

13. I bought 12 quintals of fish at 4 dollars a quintal; how many barrels of flour, at 6 dollars a barrel, will pay for the fish?

14. Charles bought 8 quarts of cranberries at 6 cents a quart, and paid in chesnuts at 4 cents a quart; how many chesnuts will pay for the cranberries?

15. If 6 men can build 4 rods of wall, each, in a day, how many rods can 8 men build, all together?

16. How many times 6, are 12 times 4?

17. How many times 8, are 4 times 6?

18. How many times 6, are 5 times 12?

19. How many times 7, are 2 times 14? 3 times 14?

20. How many times 14, are 8 times 7? 4 times 7?

THIRD SERIES OF MENTAL EXAMPLES.

N. B. To multiply any number by 10, you have only to imagine one cipher to be placed at the right hand of that number. To multiply by 100 imagine two ciphers placed at the right hand. To multiply by 1000, imagine three ciphers placed at the right hand, &c.

1. A man bought 10 cows at 18 dollars a head; to what did they amount?

2. A farmer planted 10 acres of corn, that yielded 34 bushels to the acre; how many bushels in all?

3. A man bought a farm, containing 100 acres, at 45 dollars an acre; what was the amount?

4. A general commanded 10 regiments, and each regiment consisted of 500 men; how many in all?

5. If a ship's crew of 450 men, be paid 100 dollars each, how dollars will pay them off?

An army of 1000 men were furnished with 36 ball cartridges, each; how many did it require?

7. What will 100 barrels of beef cost, at 10 dollars a barrel?
8. What must be given for 45 horses, at 100 dollars a head?
9. What must I give for 40 acres of land, at 20 dollars the acre? at 30 dollars the acre? at 40 dollars?
10. What must I give for 50 sheep, at 3 dollars a head? at 4 dollars? at 5 dollars? at 6 dollars? at 7 dollars? 8 dollars? 9 dollars?
11. A man bought a farm for 1000 dollars, for which he turned 10 young horses at 50 dollars a head, and paid the balance in money; how many dollars did he pay?
12. If a chest of tea cost 40 dollars, what will 8 cost? what will 9 cost? 10 cost? 12 cost? 7 cost? 6 cost?
13. What are 10 times 80? 100 times 80? 1000 times 80?
14. What are 10 times 75? 100 times 75? 1000 times 75?
15. What are 10 times 100? 100 times 100? 1000 times 100?
16. What are 10 times 1000? 100 times 1000?

MISCELLANEOUS QUESTIONS FOR MENTAL EXERCISE.

1. John had 30 cents, and his father gave him 15 more; how many cents had he then? How many are 30 and 25?
2. James won 36 marbles at play, but playing again he lost 16 of them; how many had he left?
3. A man sold 9 barrels of flour for 8 dollars a barrel, but lost his pocket book, containing one half the money; how many dollars had he left?
4. If I buy 9 hundred weight of sugar for 54 dollars, and sell it at 7 dollars the hundred weight, how much do I gain?
5. If I buy 7 barrels of flour at 6 dollars a barrel, what must I get for the whole of it, to make one dollar a barrel?
6. A man bought 45 acres of land at 10 dollars the acre, and will sell it all together if he can make 100 dollars by the sale; what must he get for the whole?
7. If 250 soldiers be paid 100 dollars each, out of a chest containing 50,000 dollars, how many dollars will be left?
8. If I sell to one man 10 barrels of flour at 6 dollars, and to another, 10 barrels at 5 dollars a barrel, how many dollars do I get for the whole?
9. What will 25 sheep cost, at 3 dollars a head? If the price of 25 lambs, at 2 dollars a head, be added to them, what will be the amount?
10. There were ten ships of war, each manned with 450 men, which fell into an engagement; each ship lost 50 men; how many men were left on board the 10 ships?
11. Charles sold 10 quarts of chestnuts at 4 cents a quart, and 8 quarts of walnuts at 5 cents a quart; how many cents did he get for both?

SIMPLE MULTIPLICATION.

12. A boy sold his sled for 50 cents, and his knife for 30 cents, and bought 8 story books at 10 cents a piece; how many cents had he left? How many are 10 times 40, with 10 times 20 added? 10 times 40, with 10 times 20 subtracted?

EXAMPLES FOR EXERCISE ON THE SLATE, CASE FIRST.

Q. What is the first case in Multiplication?

A. When the multiplier is not more than 12.

Q. What is the RULE?

A. Multiply every figure in the multiplicand by the multiplier separately, carry one for every ten as in addition, and you will have the product, or answer.

EXAMPLES.

(1) Multiply 14 By 2	(2) Multiply 18 By 3	(3) Multiply 33 By 4	(4) Multiply 28 By 5
—	—	—	—

(5) Multiply 34 By 6	(6) Multiply 124 By 7	(7) Multiply 137 By 8	(8) Multiply 148 By 9
—	—	—	—

(9) Multiply 213 By 10	(10) Multiply 234 By 11	(11) Multiply 375 By 12
—	—	—

12. What cost 9 barrels of flour at 4 dollars a barrel?

13. What will 12 bushels of wheat come to at 2 dollars a bushel?

14. A boy carried 14 quarts of cherries to market, and sold them for 8 cents a quart; how many cents did they come to?

15. A boy sold 18 quarts of walnuts for 6 cents a quart, and 24 quarts of chesnuts at 8 cents a quart: how many cents did both come to?

16. A market-woman sold 6 dozen of eggs for 18 cents a dozen; 5 pounds of butter for 16 cents a pound; how many cents did they amount to, and how much money had she left, after buying 2 gallons of molasses, at 26 cents a gallon?

17. A lady bought 9 yards of cloth at 27 cents a yard, and 14 yards at 8 cents a yard; what did she pay for the whole?

18. What will 34 quintals of fish come to at 3 dollars a quintal?

19. If a man travel 25 miles in one day, how far will he go in 7 days?

20. If a man set out on a journey of 146 miles, and travel 5 days at the rate of 25 miles a day, how many miles must he go the next day to finish his journey?

21. How many apples in 9 baskets, if each contain 75 apples; and how many will be left, after selling 375 of them?

22. What is the result of $14 \times 4 + 23 - 36 \times 5 - 48 + 53$?

$$\begin{array}{r} \text{Multiply } 460325789 \\ \text{By } \quad \quad \quad 2 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Multiply } 76340185 \\ \text{By } \quad \quad \quad 3 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Multiply } 64753928 \\ \text{By } \quad \quad \quad 4 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Multiply } 534870458 \\ \text{By } \quad \quad \quad 5 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Multiply } 313567893 \\ \text{By } \quad \quad \quad 6 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Multiply } 847362538 \\ \text{By } \quad \quad \quad 7 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Multiply } 6703746 \\ \text{By } \quad \quad \quad 8 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Multiply } 81726354 \\ \text{By } \quad \quad \quad 9 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Multiply } 9083756 \\ \text{By } \quad \quad \quad 10 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Multiply } 918273645 \\ \text{By } \quad \quad \quad 11 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Multiply } 896745231 \\ \text{By } \quad \quad \quad 12 \\ \hline \end{array}$$

12. What will 4 loads of hay come to at 29 dollars a load?

13. What will 475 barrels of flour cost at 7 dollars a barrel?

14. How many acres of land are in 6 sections, if each section contain 7263 acres?

15. A merchant purchased 8 bales of cloth, each bale containing 357 yards; how many yards did he buy?

16. What will 6 tons of hemp cost, at 140 dollars a ton?

17. A general has under his command, 8 brigades of soldiers; each one consists of 4750 men; how many men does he command?

18. If a ship sail 145 miles a day, how many miles will it be from its place of sailing, in 8 days?

19. A land speculator bought 3 sections of land; the first contained 5743 acres, the second contained 6975, the third

7980, for which he gave 12 dollars an acre; how many acres did he buy, and what did the purchase cost him?

20. A general received 50000 dollars to pay off his army, consisting of 4650 men; to each soldier he paid 9 dollars; how many dollars did he pay out, and how many had he left?

21. A merchant bought a vessel for 2350 dollars, and put on board 125 bbls. of beef at 7 dollars a barrel: 135 bbls. of pork at 9 dollars a barrel; 175 bbls. of flour at 6 dollars a barrel; and 175 kegs of butter at 8 dollars a keg; what was the amount of vessel and cargo, and which cost the most, and how much?

Ans. $\left\{ \begin{array}{l} \text{Vessel and cargo } \$6890. \\ \text{Cargo more than vessel } \$2190. \end{array} \right.$

CASE SECOND.

Q. What is the second case in multiplication?

A. When the multiplier consists of several figures.

Q. What is the RULE in this case?

A. Place the multiplier under the multiplicand, units under units, tens under tens, &c.; multiply by each figure in the multiplier separately, and place the first figure of each product directly under the figure by which you multiply; add all the products together, in the order in which they stand, and the sum will be the total product.

Q. Why do you place the first figure of every product, under its multiplier, instead of placing units under units, &c. as in other cases.

A. Because the *local* value of each figure in the multiplier, as you proceed towards the left, is increased ten fold, and the first figure of each product always possesses the same *local* value as the figure by which you multiply, and must therefore stand under it, in order to preserve its true value.

Q. If there are ciphers among the figures of the multiplier, what do you do with them?

A. Omit them and multiply by the other figures as usual, setting the first figure of each product under its multiplier, as before directed.

EXAMPLES.

(1)		(2)		(3)		(4)	
Multiply	37	Multiply	113	Multiply	93	Multiply	416
By	14	By	24	By	35	By	102
(5)		(6)		(7)		(8)	
Multiply	307	Multiply	538	Multiply	363	Multiply	138
By	43	By	307	By	75	By	33

9. What will 75 barrels of pork come to at 21 dollars a barrel?

10. What will 46 acres of land come to at 34 dollars per acre?

11. A farmer sold 17 tons of hay at 23 dollars a ton; what was the amount?

12. A merchant sold 46 bags of coffee, each weighing 75 lbs; what was the whole weight?

13. What will be the weight of 125 chests of tea, if each chest weighs 62 pounds?

14. A gentleman sold two lots of land; one containing 35 acres, at 22 dollars an acre; the other, containing 27 acres at 28 dollars an acre; how many dollars did he receive?

15. A merchant bought 24 hogsheads of molasses, each containing 118 gallons; and 17 hogsheads, each containing 123 gallons; how many gallons did he buy in all, and how many can he sell and have 2755 gallons left?

16. If I buy 46 casks of wine for 37 dollars a cask, and sell it again at 43 dollars a cask, how much do I gain in the whole?

17. A company of 75 men were hired to make a turnpike road, and each man was paid 25 dollars; how many dollars did the road cost?

18. The crew of a vessel, consisting of 63 men, set out on a fishing excursion; each man caught 27 fishes, except the captain and mate, who only caught 13 each; how many fishes did they bring home, after losing 226?

Multiply ⁽¹⁾ 4673253	Multiply ⁽²⁾ 73046703	Multiply ⁽³⁾ 32736453
By 36	By 407	By 6004
Prod. 168237108	Pro. 29730008121	Pro. 196549663812

Multiply ⁽⁴⁾ 376425	Multiply ⁽⁵⁾ 4073082	Multiply ⁽⁶⁾ 63047682
By 364	By 4027	By 6408

7. If each man in an army of 5675 men be required to be furnished with 36 ball cartridges, how many will be necessary for the whole army?
Ans. 204300.

8. A ship of war is to be furnished with 247 barrels of pork, at 15 dollars a barrel, and 175 barrels of beef, at 13 dollars a barrel; how many dollars will pay for the whole?
Ans. \$5930

9. A merchant bought 75 pipes of wine, each containing 126 gallons, and 175 hhds. of rum, each containing 63 gallons; how many gallons of both, and how many more of rum, than of wine?

Ans. { 20475 gallons of both:
1575 more of rum than of wine.

10. A ship has on board 2565 chests of tea, each weighing 112 lbs.; also, 1785 bags of coffee, each weighing 102 lbs.; what is the whole weight of her cargo, and how much more does the tea weigh than the coffee?

Ans. { Her cargo weighs 469350 lbs.
The tea weighs 105210 lbs. more than the coffee.

11. Bought 24 kegs of butter, each weighing, keg and all, 75 lbs., the kegs alone weighed 13 lbs. each; what was the whole weight, and how many pounds of butter, after deducting the weight of the kegs?

Ans. { Whole wt. 1800 lbs.
Wt. of butter 1488 lbs.

12. What will a farm, containing 346 acres, come to, at 47 dollars an acre?

Ans. 16262 dollars.

13. If one hhd. of tobacco weigh 496 lbs., what will be the weight of 26 hhds?

Ans. 12896 lbs.

14. If one box of sugar weigh 456 pounds, what will 45 boxes weigh, and what will they come to at 9 cents a pound?

Ans. { 20520 lbs. is their wt.
and they come to 184680 cents.

CASE THIRD.

Q. What is the third Case in Multiplication?

A. When there are ciphers at the right hand of either or both of the factors.

Q. What is the RULE in this Case?

A. Place the significant figures under each other as if there were no ciphers, and multiply by them as usual, and at the right hand of the product, place all the ciphers which stand at the right of both the factors, and you will have the answer.

EXAMPLES.

(1)	(2)	(3)
Multiply 465700	Multiply 873660	Multiply 3798000
By 4900	By 40600	By 9700
Prod. 2281930000		

4. What is the product of 49300 multiplied by 3600?

Ans. 177480000.

5. If one ounce of silver contain 480 grains, how many grains are in 140 ounces? *Ans.* 67200.
6. If one hhd. of sugar weigh 680 pounds, what will 40 hhds. weigh? *Ans.* 27200.
7. If 320 rods make a mile, how many rods will reach round the globe, it being 25000 miles? *Ans.* 8000000.
8. If you can count 150 in a minute, how many can you count in one hour?
9. If a ship could sail 250 miles in one day, how far would it go during the month of September?

CASE FOURTH.

- Q. What is the fourth Case in Multiplication?
- A. When the multiplier is a unit, with any number of ciphers annexed, as 10, 100, 1000, &c.
- Q. What is the RULE in this Case?
- A. Annex to the multiplicand all the ciphers in the multiplier, and you will have the answer.

EXAMPLES.

	(1)		(2)		(3)
Multiply	487	Multiply	784	Multiply	473
By	10	By	100	By	1000

4. What is the product of 4987 multiplied by 10000?
5. What will 496 acres of land cost at 100 dollars an acre?
6. What will 485 barrels of flour cost at 10 dollars a barrel?
7. If a ship can sail 100 miles a day, how much farther can it go during the month of January than during February?
8. If a bird can fly 1000 miles a day, how far will it fly in a year, at that rate?
9. If one bale of cotton weigh 350 pounds, what will 100 bales weigh?
10. If an army of 20000 men are to be paid off, each man to receive 100 dollars, how much money is necessary for that purpose?
11. What is the product of one million, multiplied by one million?

APPLICATION OF THE PRECEDING RULES.

1. If a manufacturer can make 150 yards of cloth in a day, how many yards can he make in 52 weeks, omitting Sunday?
Ans. 46800 yards

2. A farmer had two fields of wheat, one containing 14 acres, which yielded 35 bushels an acre; the other containing 24 acres, yielded 30 bushels an acre; how many bushels had he in the whole, and how many can he sell, and keep 150 bushels for himself?

Ans. He had 1210 bushels, and can sell 1060 bushels.

3. Bought 250 kegs of butter, each weighing 45 lbs.; the kegs weighed 9 lbs. each, after the butter was taken out; how many pounds were there of the butter alone? *Ans.* 9000 lbs.

4. A grocer bought 25 cwt. of rice at 4 dollars per cwt., 15 cwt. of sugar at 9 dollars per cwt., 35 barrels of flour at 6 dollars a barrel, and 40 quintals of codfish at 4 dollars per quintal; what was the whole cost? *Ans.* 605 dollars.

5. Bought 25 kegs of butter at 6 dollars a keg, 35 kegs of lard at 4 dollars a keg, 16 barrels of beef at 11 dollars a barrel, 37 barrels of pork at 14 dollars a barrel, and 75 barrels of flour at 8 dollars a barrel: I paid for them by giving my note for 1000 dollars, and paying cash for the balance; can you tell how much ready money I paid? *Ans.* 584 dollars.

6. A manufacturer bought 100 bales of cotton, each bale weighing 350 lbs. and each pound of cotton made 4 yards of cloth; how many yards did the 100 bales produce?

Ans. 140000 yards.

7. What is the difference between 12 times 4567 and 8 times 7654? *Ans.* 6428.

8. A merchant purchased 250 bbls. of fine flour at 7 dollars a bbl., and 275 bbls. of superfine, at 8 dollars a bbl.; the article taking a sudden rise in the market, he sold the whole for 11 dollars a barrel; how much did he make by the speculation?

Ans. 1825 dollars.

9. If the teller of a bank were to count 25000 dollars a day, one day with another, how many dollars would he count from the 20th of March to the 20th of September, including both those days? *Ans.* 4625000.

10. How many days from the birth of Christ, to Christmas 1831, allowing 365 days to the year? *Ans.* 668315 days.

11. If I buy 75 cwt. of sugar at 8 dollars a cwt., and sell 45 cwt. of it at 9 dollars a cwt., and the rest at 7 dollars a cwt., do I make or lose by the bargain, and how much?

Ans. I gain \$15.

12. A merchant had 4500 barrels of flour, and sold 2450 bbls. for 8 dollars a bbl., and the residue for 9 dollars per bbl.; how many dollars did the whole amount to? *Ans.* 38050 dolls.

13. What will be the result of the following process, viz.: $225 \times 4 - 567 + 135 \times 10 - 4000 \times 100 + 3750 - 1750$.

Ans. 70000.

DIVISION.

Q. What is division ?

A. It is finding how many times one number is contained in another, and also how much remains.

Q. How many kinds of division are there ?

A. Two ; simple and compound.

Q. What is simple division ?

A. It is when the number to be divided, is of one denomination only.

Q. How many terms are given in division ?

A. Two terms are always given to find a third.

Q. What are these terms called ?

A. The first term, or number to be divided, is called the dividend ; the second term, or number to divide by, is called the divisor ; the third term, or number found from the operation, is called the quotient, and shows how many times the divisor is contained in the dividend.

Q. If any thing be left, after dividing, what is that called ?

A. It is called the remainder, and *must always be less* than the divisor, and is always of the same denomination of the dividend.

Q. What is to be understood by the remainder being of the same denomination of the dividend ?

A. If the dividend be dollars, the remainder will be dollars ; if the dividend be pounds, the remainder will be pounds, &c.

EXAMPLES FOR MENTAL EXERCISE, SERIES I.

1. If an apple be divided into 2 equal parts, what will you call one of those parts ? and how many halves make the whole of any thing ?

2. If an orange be divided into 3 equal parts, what is one part called ? What are 2 parts called ? How many *thirds* make the whole of any thing ?

3. If any object be divided into 4 equal parts ; what is 1 part called ? What are 2 parts called ? 3 parts ? How many *fourths* make a whole ?

4. When any thing is divided into 5 parts, what is 1 part called ? 2 parts ? 3 parts ? 4 parts ? 5 parts ? How many *fifths* make the whole ?

5. When any thing is divided into 6 equal parts, what is 1 part called ? 2 parts ? 3 parts ? 4 parts ? 5 parts ? 6 parts ? How many *sixths* make the whole ?

6. When a thing is divided into 8 parts, what is 1 part called? 2 parts? 4 parts? 6 parts? 8 parts? How many *eighths* make the whole?

7. If a board were sawed into 11 equal parts, what would 1 part be called? 2 parts? 5 parts? 8 parts? 11 parts? How many *elevenths* make the whole?

8. If a piece of cloth be cut into 15 pieces of equal length, and you have 3 of those pieces, what part of it do you have? If you had 5 pieces? 7 pieces? 9 pieces? 12 pieces? How many *fifteenths* must you have, to get the whole?

9. If an acre of land be divided equally among 16 men, how much will each man have? How much will 4 of them have? 8 of them? 12 of them? How much will be left?

10. Twenty men drew 2000 dollars; what part did each man claim? What part did 5 claim? 10 claim? 15 claim? How many *twentieths* in the whole?

SECOND SERIES OF MENTAL EXAMPLES.

1. How many times 2 are there in 1?

Answer, no times, and 1 over.

What is that 1 over called? Answer, one half. Why is it called one half? Answer, any thing divided into 2 parts, one of the parts is a half.

2. How many times 2 are there in 3?

Answer, one time and 1 over. What is this 1 over? Answer, one half. What then is the half of 3? Answer, one whole one, and the half of a whole one.

3. How many times 2 in 4? What then is the half of 4? Why?

4. How many times 2 in 5? What is this 1 over? What then is the half of 5?

5. What is the half of 6? of 7? of 8? of 9? of 10? of 11? of 12? of 13? of 14? of 15? of 16? of 17? of 18? of 19? of 20?

6. How many times 3 in 1? Answer, no times, and 1 over? What is this 1 over? Answer, one third. Why?

7. How many times 3 in 2? No times, and 2 over. What is this 2 over? Why?

8. How many times 3 in 3? 3 in 4? 3 in 5? 3 in 6? 3 in 7? 3 in 8? 3 in 9? 3 in 10? 3 in 11? 3 in 12? 3 in 13? 3 in 14? 3 in 15? 3 in 16? 3 in 17? 3 in 18? 3 in 19? 3 in 20?

9. How many times 4 in 1? 4 in 2? 4 in 3? 4 in 4? 4 in 5? 4 in 6? 4 in 7? 4 in 8? 4 in 9? 4 in 10? 4 in 11? 4 in 12? 4 in 13? 4 in 14? 4 in 15? 4 in 16? 4 in 17? 4 in 18? 4 in 19? 4 in 20?

10. How many times 5 in 1? 5 in 2? 5 in 3? 5 in 4? 5 in 5? 5 in 6? 5 in 7? 5 in 8? 5 in 9? 5 in 10? 5 in 11? 5 in 12? 5 in 13? 5 in 14? 5 in 15? 5 in 16? 5 in 17? 5 in 18? 5 in 19? 5 in 20?

11. How many times 6 in 1? 6 in 2? 6 in 3? 6 in 4? 6 in 5? 6 in 6? 6 in 7? 6 in 8? 6 in 9? 6 in 10? 6 in 11? 6 in 12? 6 in 13? 6 in 14? 6 in 15? 6 in 16? 6 in 17? 6 in 18? 6 in 19? 6 in 20?

12. How many times 7 in 8? 7 in 9? 7 in 10? 7 in 12? 7 in 14? 7 in 16? 7 in 18? 7 in 21? 7 in 25? 7 in 28? 7 in 30? 7 in 35? 7 in 38? 7 in 40? 7 in 42? 7 in 47? 7 in 49? 7 in 56? 7 in 63?

13. How many times 8 in 12? 8 in 16? 8 in 20? 8 in 24? 8 in 28? 8 in 32? 8 in 35? 8 in 40? 8 in 46? 8 in 48? 8 in 54? 8 in 56? 8 in 62? 8 in 64? 8 in 72? 8 in 80?

14. How many times 9 in 12? 9 in 17? 9 in 18? 9 in 24? 9 in 27? 9 in 33? 9 in 36? 9 in 42? 9 in 45? 9 in 50? 9 in 56? 9 in 60? 9 in 63? 9 in 70? 9 in 72? 9 in 81?

15. How many times 11 in 15? 11 in 22? 11 in 30? 11 in 33? 11 in 40? 11 in 44? 11 in 50? 11 in 55? 11 in 60? 11 in 66? 11 in 70? 11 in 77? 11 in 80? 11 in 88? 11 in 90? 11 in 99?

16. How many times 12 in 14? 12 in 20? 12 in 24? 12 in 30? 12 in 36? 12 in 40? 12 in 48? 12 in 54? 12 in 60? 12 in 68? 12 in 72? 12 in 80? 12 in 84? 12 in 90? 12 in 96? 12 in 100? 12 in 108? 12 in 116? 12 in 120? 12 in 128? 12 in 132? 12 in 136? 12 in 140? 12 in 144?

17. Seven men earned 18 dolls.; what was each man's share?

18. A lady gave 3 oranges to 6 little girls; how much had each?

19. A boy gave 9 apples to his 5 little brothers; how many had each?

20. A man gave 36 peaches to 11 boys; how many had each?

21. A man sold a watermelon to 7 boys; how much of it had each boy?

THIRD SERIES OF MENTAL EXAMPLES.

1. How many pounds of meat can I buy for 100 cents, at 8 cents the pound? at 9 cents? at 12 cents?

2. How many quarts of chesnuts can John buy for 37 cents, if he give 5 cents a quart? At 6 cents a quart?

3. *Julia's* father gave her 50 cents, to buy lace at 6 cents a yard; how many yards could she buy?

4. How many barrels of flour can be bought for 75 dollars, at 8 dollars the barrel?
5. If 9 yards of cloth will make a suit of clothes, how many suits will 65 yards make?
6. How many 8 gallon kegs can be filled from 72 gallons?
7. A man bought sheep, to the amount of 60 dollars, and paid 5 dollars a head; how many did he buy?
8. At 2 dollars a bushel, how much wheat can I buy for 39 dollars? How much for 23 dollars? For 19 dollars?
9. At 4 dollars a barrel, how much can you buy for 1 dollar? How much for 2? for 3? for 5? for 7?
10. When apples are half a cent a piece, how many can you buy for 7 cents? for 9 cents? for $12\frac{1}{2}$ cents?
11. When apples are sold 3 for a cent, how many can you buy for 8 cents? for 6 cents? for 11 cents? for 12 cents?
12. When peaches are 3 cents a piece, how many can you buy for 36 cents? How many at 4 cents? at 5 cents?
13. When corn is half a dollar a bushel, how many bushels can I buy for 9 dollars and one half?
14. A market-woman sold berries to the amount of 75 cents, at 9 cents a quart; how many quarts did she sell? How much sugar can she buy with the money, at 12 cents a pound?
15. A merchant sold flour at 6 dollars a barrel, to the amount of 54 dollars; how many barrels did he sell? If he lays out his money in beef, at 9 dollars a barrel, how many barrels can he buy?
16. How many 100 weight of sugar can be bought for 89 dollars, if I give 9 dollars a 100?
17. How many times 8 in 89? 8 in 75? 8 in 63? 8 in 96?

FOURTH SERIES OF MENTAL EXAMPLES.

1. A man sold 8 barrels of flour at 6 dollars a barrel, and took his pay in fish at 4 dollars a quintal; how many quintals paid for the flour? How many times 4, in 6 times 8?
2. A boy sold 9 quarts of berries, at 4 cents a quart, and laid out his money for coffee, at 12 cents a pound; how many pounds of coffee could he buy? How many times 12, in 4 times 9?
3. A market-boy sold his eggs for 72 cents, and bought 8 pounds of cheese with the money; how much a pound did he give for the cheese?
4. A man sold 900 of sugar, and received for his pay 12 barrels of flour at 6 dollars a barrel; what did he sell his sugar at

5. How many quarts of chesnuts, at 8 cents a quart, can John buy for 10 quarts of walnuts at 6 cents a quart? How many times 8, in 6 times 10?

6. A stationer sold 9 dozen books, at 5 dollars a dozen, and took his pay in paper at 6 dollars a ream; how many reams of paper did he receive? How many times 6, in 5 times 9?

7. A man sold 40 acres of land at 10 dollars an acre, and took his pay in horses at 50 dollars a head; how many horses paid for the land? How many times 50, are in 10 times 40?

8. Mr. B. gave to his sons, Charles and John, 30 cents, in such a way, that Charles had twice as many as John; how many cents had each?

9. How can you divide 48 cents between 2 boys, so that 1 of them shall have 3 times as many as the other?

10. How many times 8, in 9 times 6; how many over?

11. How many times 7, in 5 times 12; how many over?

12. How many times 6, in 8 times 7; how many over?

13. How many times 12, in 11 times 11; how many over?

MISCELLANEOUS EXAMPLES FOR MENTAL EXERCISE.

1. If I sell 2 yards of cloth at 5-eighths of a dollar a yard, how much do I get for the cloth? How much is 10-eighths of a dollar? 12-eighths? 14-eighths? 16-eighths?

2. John found 72 chesnuts, and gave his brother 1-eighth of them; how many did he give him?

3. Charles found a certain number of walnuts, and gave 9 of them to his sister, which was 1-ninth of the whole; how many nuts did he find? Of what number is 9 the 1-ninth?

4. Of what number is 9 the 1-eighth? the 1-seventh? the 1-sixth? the 1-fifth? the 1-fourth? the 1-third?

5. If 1-third of a ship be worth \$3000, what will 2-thirds be worth? What will the whole be worth?

6. A man sold 5-ninths of a ship; how much of it did he still own? How many 9ths make the whole?

7. A man bought 2-8ths of a house, and afterwards bought $\frac{1}{8}$ ths more; how many more 8ths must he buy to get the whole?

8. What will 5 yards of cloth cost at 3-8ths of a dollar the yard? At 4-8ths the yard? at 5-8ths? at 6-8ths?

9. When corn is 6-8ths of a dollar a bushel, what will 6 bushels cost? What 7? what 8? what will 10?

10. How many barrels of flour, at 6 dollars a barrel, must I give for 12 yards of cloth, at 5 dollars the yard?

11. What number will be equal to 6-7ths of 84?

12. If 3-4ths of a chest of tea be worth 24 dollars, what will the whole be worth? What will 2 chests be worth?

SIMPLE DIVISION.

13. What number is that, of which 7 is the 8th part?
14. If $2\frac{5}{8}$ ths of a bushel of corn cost 20 cents, what will 2 bushels cost? How many are $8\frac{5}{8}$ ths of 50?
15. If I buy $3\frac{7}{8}$ ths and $4\frac{7}{8}$ ths of a vessel, how much of it do I own? How many are $6\frac{7}{8}$ ths of 63?
16. What will 9 yards of cloth cost at $3\frac{4}{8}$ ths of a dollar the yard?
17. When wheat is 9 shillings a bushel, what will 1 peck be worth? 2 pecks? 3 pecks? What will 2 bushels?
18. What number, divided by 8, will produce 9 for a quotient? What will produce 12 as a quotient?
19. What number, multiplied by 8, will produce 96?
20. What number, added to 19, will make 30?
21. What number, taken from 36, will leave 24?
22. If I sell 8 barrels of flour for 48 dollars, and thereby lose 8 dollars, what did it cost a barrel?
23. If you buy 7 yards of cloth for 35 dollars, and wish to make 8 dollars by selling it, for what must you sell it a yard?
24. What number, added to 6, and the sum multiplied by 9, will produce 108?
25. What number, added to 29, and the sum divided by 9, will produce 5 for a quotient?
26. When wheat is $6\frac{1}{8}$ ths of a dollar the bushel, what will 1 peck cost? What will 2 pecks? 3 pecks?
27. John lost $1\frac{1}{5}$ th of his marbles, and then had 32 left; how many did he lose, and how many had he at first?
28. A market-man sold a box of butter for $12\frac{1}{4}$ cents a pound, $1\frac{1}{4}$ th of which amounted to 1 dollar; how much butter was in the box?
29. A man set out on a journey, and travelled the first day 25 miles, which was $1\frac{1}{6}$ th of the whole distance; how many days will he be performing the journey, and how many miles in all?
30. What number divided by 8, will produce $1\frac{8}{8}$? $3\frac{8}{8}$? $6\frac{8}{8}$? $1\frac{1}{2}$? $3\frac{1}{4}$ ths?
31. What number, multiplied by 6, will produce 1? Will produce 2? 3? 4? 5? 6?
33. If I buy 7 barrels of flour at 6 dollars a barrel, and wish to keep one for myself, and sell the other 6 for enough to pay for the whole, what must I get a barrel for?

SHORT DIVISION.

- Q. What is meant by Short Division?
It is when the divisor is not more than 12.

Q. What is the **RULE** for short division ?

A. Find how many times the divisor is contained in the first figure or figures of the dividend ; place the result underneath, and if any thing remain, call it so many tens ; that is, if 1 be over, call it 10 ; if 2 be over, call it 20 ; if 3, 30, &c. and add it to the next figure of the dividend ; then divide *this* sum as before, and thus continue until you have divided all the figures of the dividend.

Q. How do you prove short division ?

A. Multiply the quotient by the divisor, and add in the remainder, and if the product be equal to the dividend, the work is right.

EXAMPLES FOR EXERCISE ON THE SLATE.

$$\begin{array}{r} \text{Divisor } 2 \overline{)24} \\ \text{Divisor } 3 \overline{)36} \\ \text{Divisor } 5 \overline{)48} \\ \text{Divisor } 6 \overline{)138} \end{array}$$

$$\begin{array}{r} \text{Divisor } 8 \overline{)170} \\ \text{Divisor } 8 \overline{)297} \\ \text{Divisor } 11 \overline{)240} \\ \text{Divisor } 12 \overline{)269} \end{array}$$

9. If 36 chesnuts be divided among 3 boys, how many does each boy have ?

10. Three boys earned 45 cents ; how many cents had each boy ?

11. Four men received 140 dollars for doing a job of work ; how many dollars did each man receive ?

12. If 4 yards of cloth will make a suit of clothes, how many suits will 136 yards make ?

13. If a man travels 225 miles in 5 days, how many miles does he travel in each day ?

14. If one man can build a house in 365 days, how long will 5 men be in doing the same ?

15. Henry found 225 chesnuts, Samuel found 134, and James found 175. They divided them equally among themselves, and their three little sisters ; how many had each ?

16. James sold 14 watermelons at 6 cents apiece, John sold 28 pears at 3 cents apiece, and Joseph sold 36 peaches at 2 cents apiece ; out of all the money, they bought 4 lbs. of coffee at 15 cents a pound, and divided what was left equally between them ; how many cents had each boy ?

17. A company of 9 men purchased three tickets in a lottery ; one ticket drew 1758 dollars, another 730 dollars, and the last came up a prize of 500 dollars ; what was each man's share ?

18. How many 8 gallon kegs, can be filled from 4 casks of wine, each cask containing 64 gallons ?

19. Six men went on a gunning expedition; during three days they shot 67 plover, 36 snipe, 103 quails, and 76 part-ridges; after dividing the spoil, what was each man's part ?

20. A boy was rolling a hand-cart with 36 bundles of starch in it, and the wheel coming off, prevented him from going any farther; 6 of his playmates coming along offered to carry the bundles for him; how many bundles did each of his friends carry ?

21. Seven boys at school read 3 pages to the master, each page contained 42 lines; how many lines was each boy's share ?

$$\begin{array}{r} \text{Divisor } 2 \overline{) 3462378} \quad \text{Divisor } 3 \overline{) 4675089} \quad \text{Divisor } 4 \overline{) 98764123} \end{array}$$

$$\begin{array}{r} \text{Divisor } 5 \overline{) 121623124} \quad \text{Divisor } 6 \overline{) 247212063} \end{array}$$

$$\begin{array}{r} \text{Divisor } 7 \overline{) 2181431260} \quad \text{Divisor } 8 \overline{) 29712358} \end{array}$$

$$\begin{array}{r} \text{Divisor } 9 \overline{) 65431268} \quad \text{Divisor } 10 \overline{) 206535090} \end{array}$$

$$\begin{array}{r} \text{Divisor } 11 \overline{) 1065266571} \quad \text{Divisor } 12 \overline{) 157626526723} \end{array}$$

12. If 9 barrels of pork cost 153 dollars, how much is that a barrel ?

13. A field of 6 acres yielded 270 bushels of corn; how many bushels was that to the acre ?

14. If a button maker can make 150 buttons in a day, how many dozen can he make in 30 days ?

15. If I sell 8 barrels of beef for 80 dollars, and thereby gain 16 dollars, can you tell me how much it cost a barrel ?

16. If a pigeon can fly across the Atlantic, a distance of 3000 miles, in 8 days; how far must it fly each day ?

17. If I give 64 dollars for 8 barrels of flour, how must I sell it a barrel, in order to gain 16 dollars by the sale ?

18. A man dying left an estate worth 250000 dollars, but his debts amounted to \$75000, to be paid out of it; the remainder was equally divided among his 6 children; how much each child's share ?

Ans. 29166 $\frac{2}{3}$ dolls.

LONG DIVISION.

Q. What is Long Division ?

A. It is when the divisor is more than 12.

Q. What is the RULE for long division ?

A. First see how many of the left hand figures of the dividend are necessary to make a number as large, or larger, than the divisor, then see how many times the divisor is contained in these figures ; place the result at the right hand of the dividend for the first quotient figure, multiply the divisor by this quotient figure, and place the product under those figures of the dividend which you use, then subtract it therefrom, and to the right hand of the remainder bring down the next figure of the dividend ; thus continue to seek, multiply, subtract and bring down, until you have used all the figures of the dividend.

Q. If when you have multiplied your divisor by the quotient figure, the product be larger than that part of the dividend used, what must you do ?

A. My quotient figure is too *large* : I must therefore rub out the last process, and place a *smaller* figure in the quotient.

Q. If, on subtracting the product from that part of the dividend used, your remainder be larger than the divisor, what must you do ?

A. My quotient figure is too *small* : I must therefore rub out the last process, and place a *larger* figure in the quotient.

Q. After bringing down a figure to the remainder, if the new dividend be too small to contain the divisor, what must you do ?

A. Place a cipher in the quotient, bring down another figure, and proceed as before.

Q. How do you prove long division ?

A. Multiply the quotient by the divisor, and if there be any remainder, add it in ; should the product be equal to the dividend, the work has been performed right ; or divide the dividend by your quotient, and if the *last quotient* be equal to your *first divisor*, the sum is correct.

EXAMPLES.

⁽¹⁾ Divisor 14)1696(191 Quot. 14 29 28 16 14 2 Remainder.	⁽²⁾ Divisor 14)1709(122 Quot. 14 30 28 29 28 1 Rem
---	--

Divisor 15)⁽³⁾345(23 Quot.

Divisor 15)⁽⁴⁾3510(234 Quot.

Divisor 16)⁽⁵⁾3564(

Divisor 16)⁽⁶⁾4237(

7. If 196 be divided by 14, what will the quotient be ?

8. A section of land containing 1885 acres was divided into 13 farms; how many acres did each farm contain ?

9. How many kegs, containing 18 gallons each, can be filled from 4 casks of wine each containing 108 gallons? *Ans.* 24.

10. Twenty-five men were employed in building a cotton factory, the labor of which amounted to 3125 dollars; how much did each man receive ? *Ans.* \$125.

11. A farmer sold 21 acres of land for 210 dollars, by which he lost 42 dollars; how much did it cost him per acre ?

12. A privateer in the last war took a prize worth \$8050; the owners claimed \$4025, the captain claimed \$375, and the mate 275 dollars; the residuc was divided among the sailors, 25 in number; what was each seaman's share ? *Ans.* 135 dollars.

13. Eighteen wagons were employed to transport 810 bushels of salt; how many bushels to each wagon ?

N. B.—In order to give the scholar an opportunity of exercising his judgment in finding the proper quotient figure, I have set in the quotient's place such a sum as will be produced by multiplying the *true* quotient by 2, and adding in the remainder. The scholar therefore need only multiply *his* quotient by 2, (adding in the remainder if any,) and if the *product* agree with the figures I have placed in the *answer*, he may venture to call his work right; as the following examples will show.

1. Divisor 14)156970998(Quotient $\times 2$ + the Remainder.

22424430 *Ans.*

2. Divisor 16)1243789469(Quot. $\times 2$ + the Rem.

155473695 *Ans.*

3. Divisor 25)290327894(Quot. $\times 2$ + the Rem.

23226249 *Ans.*

4. Divisor 36)168236008(Quot. $\times 2$ + the Rem.

9346460 *Ans.*

5. Divisor 37)463728192(Quot. $\times 2$ + the Rem.

25066402 *Ans.*

6. Divisor 125)1067324678(Quot. $\times 2$ + the Rem.

17077247 *Ans.*

7. Divisor 246)610194144(Quot. $\times 2$ + the Rem.

4960928 *Ans.*

8. Divisor 416)1438024224(Quot. $\times 2 +$ the Rem.
6913578 *Ans.*

9. Divisor 2467)987654321(Quot. $\times 2 +$ the Rem.
801431 *Ans.*

10. If a cannon-ball were to continue with the same rapid flight as when leaving a cannon's mouth, it would travel about 11516 miles in one day; how many days would it be in going from the earth to the sun, a distance of 95000000 miles?

Ans. $\times 2 +$ Rem. 21014 days.

11. How many firkins, each holding 45 lbs. can be filled from 45900 lbs. of lard?

Ans. $\times 2 = 2040$ lbs.

12. On the first day of January, 1816, the public debt of the United States amounted to 123016375 dollars: Now if a man could count 75423 dollars in one day, in how many days could he count the whole debt?

Ans. $\times 2 +$ Rem. = 4724 days.

13. A wine merchant bought 14 pipes of wine, each containing 126 gallons; if he wish to put it into quarter casks, each containing 32 gallons, how many casks must he buy?

Ans. $\times 2 +$ Rem. = 114.

14. If a steam-boat can sail in one day, 245 miles, how long will she be in passing round the earth, a distance of 25000 miles?

Ans. $\times 2 +$ Rem. = 214 days.

15. A cistern holding 4690 gallons of water, is required to be emptied; how long will a man be in pumping it dry, at the rate of 35 gallons a minute?

Ans. $\times 2 = 268$ minutes.

16. How many lots, each containing 16 acres, can be fenced in, from a farm containing 368 acres?

Ans. $\times 2 = 46$.

17. There is a fountain of water containing 1237750 gallons; how long will a force pump, which discharges 250 gallons in a minute, be in emptying this fountain?

Ans. $\times 2 = 9902$ minutes.

18. If a township contain 64000 acres of land; how many farms, each containing 200 acres, can be laid out in it, and if each farm be inhabited by 8 persons, how many inhabitants are there in the town?

CASE SECOND.

Q. What is the second Case in Long Division?

A. When there are ciphers at the right hand of the divisor.

Q. What is the RULE in this Case?

A. Cut off the ciphers in the divisor, and as many figures from the right hand of the dividend; then divide the remaining part of the dividend, by the significant figures of the divisor, as before taught, and to the remainder annex the which were cut off from the dividend, and you will

same remainder which would result from dividing by the whole divisor ; if there be no remainder, after dividing, bring down the figures which were cut off from the dividend, and they will constitute the remainder.

EXAMPLES.

1. Divisor 14600)37548659732(Quotient $\times 2 +$ Remainder.
5143784 *Ans.*
2. Divisor 375000)7849345678(Quot. $\times 2 +$ Rem.
262540 *Ans.*
3. Divisor 433000)53729614529(Quot. $\times 2 +$ Rem.
624701 *Ans.*
4. Divisor 16730000)1230450670890(Quot. $\times 2 +$ Rem.
9507984 *Ans.*
5. Divisor 1200)103789467(
6. Divisor 900)123478625(
7. Divisor 8000)3746789000(
8. Divisor 40)37678925(
9. A general, commanding an army of 44000 men, received 5676320 dollars to be equally divided among them, so long as each man could receive a dollar, and whatever was left, the general was to have for his share; what was each soldier's part, and how much remained for the commander ?
Ans. { Each soldier's share \$129.
The general's share \$320.
10. What number multiplied by 3600 will produce 457200 ?
Ans. 127.
11. If, in a town containing 25000 inhabitants, a tax of 567000 dollars be assessed, to be paid equally by each person, how many dollars will each pay ?
12. If a certain quotient be 437000, and the dividend be 587-765000, what is the divisor ?
Ans. 1345.
13. Suppose a pond to contain 984960000 cubic feet of water, and a sluice-way to discharge 4500 cubic feet in a minute, how many minutes will it take to draw the pond dry ?
Ans. 218880 minutes.

CASE THIRD.

Q. What is the third Case in Long Division ?

A. When the divisor is an unit with any number of eiphers annexed, as 10, 100, 1000, 10000, &c.

What is the RULE in this Case ?

off as many figures from the right hand of the dividend as are ciphers in the divisor, and the figures at the

left hand of the cut-off will be the quotient, and those at the right hand, the remainder.

EXAMPLES.

1. Divide 4873 by 10. *Ans.* 487, and 3 remains.
2. Divide 398763 by 100. *Ans.* 3987, 63 rem.
3. Divide 408721436 by 1000.
4. Divide 6543167102 by 10000.
5. If 100 acres of land cost 15600 dollars; what is that an acre?
6. If 10 horses cost 450 dollars, what was the price of each horse?
7. If 100 barrels of flour cost 800 dollars, what is that per barrel?
8. If 1000 barrels of beef cost 14000 dollars, how much is that per barrel?
9. If a hound run 150 miles in 10 hours, how much is that an hour?

 SUPPLEMENT TO MULTIPLICATION AND
DIVISION.

Q. How will you express any part of a unit or one, as one half, one third, or two thirds?

A. By a term called a Fraction.

Q. How is a fraction expressed, or written?

A. By two figures, one placed above the other, with a line drawn between them, thus: $\frac{1}{2}$ represents one half; $\frac{2}{3}$ represents one third; $\frac{4}{3}$ represents two thirds, &c.

Q. What does the *lower* figure of a fraction always show?

A. It shows how many parts the unit or whole number is divided into.

Q. What does the *upper* figure show?

A. It shows how many of these parts are meant to be included in the fraction; (thus $\frac{3}{4}$ means that the unit is divided into 4 parts, and that 3 of these parts are meant by the fraction: also, when I say I own $\frac{5}{8}$ of a ship, I mean that the ship is divided into 8 shares, and that I own 5 of those shares.)

Q. By what name are the figures which form a fraction distinguished from each other?

A. The figure *above* the line is called the *numerator*; the figure *below* the line, is called the *denominator*.

Q. From what do fractions arise, and how are they produced?

A. All fractions arise from division. When any number is divided by another, and there is a remainder, that remainder is a numerator, and the divisor is a denominator; and then a fraction is produced; as 28 divided by 6 leaves a remainder of 4; this 4 is the numerator of a fraction, and the divisor 6, is the denominator: thus, $\frac{4}{6}$, showing that if 28 be divided into 6 parts, each part will be $4\frac{4}{6}$ that is, 4 units, and $\frac{4}{6}$ of a unit.

Q. What is such a number as $4\frac{4}{6}$ called?

A. It is called a mixed number.

Q. What is the definition then of a mixed number?

A. It is a whole number, joined with a fraction, as $5\frac{1}{2}$, $7\frac{1}{2}$, $6\frac{1}{2}$, $14\frac{1}{2}$, $28\frac{1}{2}$, &c.

CASE FIRST.

Q. What is the first Case?

A. It is when the *Multiplier* is a mixed number, as $6\frac{1}{2}$, $24\frac{1}{2}$, $31\frac{1}{2}$, &c.

Q. What is the RULE in this Case?

A. Multiply by the whole number as in Multiplication; then divide the multiplicand by the lower figure, or denominator of the fraction, and add this quotient to the product, and the sum will be the answer.

Q. How would you multiply by a simple fraction, as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, &c.?

A. Divide the multiplicand by the lower figure of the fraction, and the quotient will be the answer.

EXAMPLES.

(1)
Multiply 4673 by $23\frac{1}{2}$

Operation. $2)4673$
 $23\frac{1}{2}$

14019

9346

Quotient. $2336\frac{1}{2}$

Ans. 109815 $\frac{1}{2}$

(2)
Multiply 7564 by $18\frac{1}{2}$

Operation. $8)7564$
 $18\frac{1}{2}$

60512

7564

Quotient. $945\frac{1}{2}$

Ans. 137097 $\frac{1}{2}$

(3)
Multiply 4962
By $46\frac{1}{2}$

(4)
Multiply 5392
By $108\frac{1}{2}$

(5)
Multiply 2659
By $58\frac{1}{2}$

$9492\frac{3}{4}$ or $\frac{1}{2}$

Ans. 584133 $\frac{1}{2}$

Ans. 154753 $\frac{1}{2}$

6. What cost 45 yards of superfine broadcloth, at $9\frac{1}{2}$ dollars per yard?
Ans. \$416 $\frac{1}{2}$.

7. What cost 147 barrels of flour, at $7\frac{1}{2}$ dollars per barrel?
Ans. \$1047 $\frac{1}{2}$.

8. What is the weight of 45 hhds. of tobacco, if each weigh $4\frac{1}{2}$ cwt.
Ans. 202 $\frac{1}{2}$ cwt.

9. If $5\frac{1}{2}$ yards make a rod, how many yards in 330 rods?
Ans. 1760.

10. What cost 375 acres of land, at $24\frac{1}{2}$ dollars per acre?
Ans. \$9187 $\frac{1}{2}$.

11. How many gallons of wine in 150 quarter casks, each containing $31\frac{1}{2}$ gallons?
Ans. 4725.

12. What cost 487 bushels of wheat, at $1\frac{1}{2}$ dollar per bushel?
Ans. \$730 $\frac{1}{2}$.

13. One hundred and fifty passengers came in the steam-boat from New-York, and each paid for passage $6\frac{1}{2}$ dollars; how much was received from all?
Ans. \$937 $\frac{1}{2}$ or $\frac{1}{2}$.

CASE SECOND.

Q. What is the second Case?

A. When the *Multiplicand* is a mixed number.

Q. What is the RULE in this Case?

A. If the multiplier is not more than 12, multiply the numerator of the fraction by the multiplier, and divide the product by the denominator, and if any thing remain, set it underneath for a numerator to the given denominator, and carry the quotient to the product of the next figure, and proceed as usual.

Q. When the multiplier is larger than 12, how do you proceed?

A. Multiply the *whole numbers* together, as before; then divide the *multiplier* by the denominator of the fraction, and add the quotient and product together, as before, and their sum will be the answer.

EXAMPLES.

(1)
 Multiply $468\frac{1}{2}$ by 14.
 Operation. $468\frac{1}{2}$
 2) 14

 1872
 468
 Quotient. 7

Ans. 6559

(2)
 Multiply $378\frac{1}{2}$ by 36.
 Operation. $378\frac{1}{2}$
 4) 36

 2268
 1134
 Quotient. 9

Ans. —

$$\begin{array}{r} \text{Multiply} \quad (3) \\ 376\frac{1}{2} \\ \text{By} \quad 16 \\ \hline \end{array}$$

Ans. 6024

$$\begin{array}{r} \text{Multiply} \quad (4) \\ 986\frac{1}{2} \\ \text{By} \quad 24 \\ \hline \end{array}$$

Ans. 23670

5. A grocer bought 4 chests of tea, each weighing $63\frac{1}{2}$ lbs.; how many pounds in all? *Ans.* 249.

6. What will 5 pieces of cloth, each piece containing $24\frac{1}{2}$ yards, come to, at 9 dollars a yard? *Ans.* 1102 $\frac{1}{2}$.

7. A merchant bought 140 quarter casks of wine, each cask holding $31\frac{1}{2}$ gallons; how much wine in all his casks? *Ans.* 4410.

8. What will $137\frac{1}{2}$ acres of land amount to, at 12 dollars per acre? *Ans.* \$1650.

9. Bought 7 bales of goods, each bale containing $24\frac{1}{2}$ pieces, and each piece 36 yards; how many yards in the whole, and what will they cost at $\$3\frac{1}{2}$ per yard? *Ans.* 6174 yards, and they cost \$20065 $\frac{1}{2}$.

10. Bought 9 boxes of sugar, each box containing $4\frac{1}{2}$ cwt.; what did the whole weigh, and what did it cost at 9 dollars per cwt. *Ans.* Whole wt. $40\frac{1}{2}$ cwt., cost \$364 $\frac{1}{2}$.

CASE THIRD.

Q. What is the third Case?

A. When the numerator of the fraction is more than 1, as $\frac{3}{4}$, $\frac{5}{8}$, $4\frac{1}{2}$, $15\frac{3}{4}$, &c.

Q. What is the RULE in this Case?

A. Multiply the whole numbers together, as in former cases: then (if the *multiplier* be a mixed number) write the *multiplier* in another place, and multiply it by the *numerator* of the fraction, and divide the product by the *denominator*; then add this quotient to the first product, and their sum will be the answer.

Q. When the *multiplicand* is a mixed number, and the numerator of the fraction more than 1, how do you proceed?

A. Multiply the whole numbers as before, then write the *multiplier* in another place, multiply it by the numerator of the fraction, and divide the product by the denominator: then add the quotient to the product, and their sum will be the answer.

Q. If the multiplier be a simple fraction, only, as $\frac{2}{3}$, $\frac{3}{5}$, $\frac{4}{7}$, &c., how do you multiply by it?

A. Multiply the *multiplicand* by the numerator of the fraction, divide the product by the denominator, and the quotient will be the answer.

EXAMPLES.

$$\begin{array}{r} \text{Multiply } 452 \text{ by } 6\frac{1}{2} \\ \text{Operation. } \begin{array}{r} 452 \\ 6 \quad 3 \text{ Nu.} \\ \hline 2712 \\ 4)1356 \\ \hline 339 \end{array} \\ \text{Quo. added } 339 \\ \hline \text{Ans. } 3051 \end{array}$$

$$\begin{array}{r} \text{Multiply } 873 \text{ by } 9\frac{1}{2} \\ \text{Operation. } \begin{array}{r} 873 \\ 9 \quad 5 \text{ Nu.} \\ \hline 7857 \\ \text{D. } 8)4365 \\ \hline 545\frac{1}{2} \end{array} \\ \text{Qt. added } 545\frac{1}{2} \\ \hline \text{Ans. } 8402\frac{1}{2} \end{array}$$

$$\begin{array}{r} \text{Multiply } 2145 \\ \text{By } 26\frac{2}{3} \\ \hline \text{Ans. } 57200 \end{array}$$

$$\begin{array}{r} \text{Multiply } 1897 \\ \text{By } 36\frac{2}{3} \\ \hline \text{Ans. } 69951\frac{1}{3} \end{array}$$

$$\begin{array}{r} \text{Multiply } 9402 \\ \text{By } 37\frac{2}{3} \\ \hline \text{Ans. } 351634\frac{2}{3} \end{array}$$

$$\begin{array}{r} \text{Multiply } 4908 \\ \text{By } 16\frac{2}{3} \\ \hline \text{Ans. } 81595\frac{1}{3} \end{array}$$

7. What cost 124 yards of silk, at $1\frac{1}{2}$ dollar a yard?
Ans. \$170,50 cts.
8. What cost 48 yards of satin, at $\frac{5}{8}$ of a dollar per yard?
Ans. \$36.
9. What cost 36 yards of broadcloth, at $5\frac{1}{2}$ dollars per yard?
Ans. \$211,50.
10. What cost $28\frac{5}{8}$ yards of cloth, at 8 dollars per yard?
Ans. \$230.
11. What cost 127 bushels of rye, at $\frac{1}{5}$ of a dollar a bushel?
Ans. \$111.
12. What cost 145 gallons of wine, at $2\frac{1}{2}$ dollars per gallon?
Ans. \$362.

CASE FOURTH.

Q. What is the fourth Case ?

A. When the multiplier and multiplicand are both mixed numbers.

Q. What is the RULE in this Case ?

A. Multiply each term by the denominator of its own fraction, and add in the numerator : multiply these products together and make this last product a dividend : then multiply the denominators of the two fractions together and make product a divisor : divide, and the quotient will be the

EXAMPLES.

(1)
Multiply $36\frac{1}{2}$ by $4\frac{3}{5}$
Operation $36\frac{1}{2}$ $4\frac{3}{5}$

2	5
73	23
23	
219	
146	

$$2 \times 5 = 10 \overline{)1679}$$

Ans. $167\frac{9}{10}$

(2)
Multiply $22\frac{1}{2}$ by $9\frac{1}{2}$
Operation $22\frac{1}{2}$ $9\frac{1}{2}$

3	4
67	39
39	
603	
201	

$$3 \times 4 = 12 \overline{)2613}$$

Ans. $217\frac{2}{12}$ or $\frac{1}{3}$.

3. What is the product of $36\frac{1}{2}$ multiplied by $9\frac{1}{2}$?

Ans. $333\frac{1}{4}$.

4. What is the product of $16\frac{1}{2}$ multiplied by $2\frac{1}{2}$?

Ans. $35\frac{1}{4}$ or $\frac{1}{4}$.

5. What is the weight of $14\frac{1}{2}$ bushels of wheat, each bushel weighing $54\frac{1}{2}$ lbs.?

Ans. $793\frac{1}{2}$ lbs.

6. What will $14\frac{1}{2}$ cwt. of sugar come to at $7\frac{1}{2}$ dollars per cwt.?

Ans. $\$106\frac{1}{4}$.

7. A merchant bought 5 quarter casks of wine, each containing $31\frac{1}{2}$ gallons; what will be the amount at $3\frac{1}{2}$ dollars per gallon?

$\$511\frac{1}{4}$.

8. What will $27\frac{1}{2}$ yards of broadcloth come to, at $4\frac{1}{2}$ dollars per yard?

Ans. $\$117\frac{1}{4}$.

9. What cost $6\frac{1}{2}$ tons of hay at $14\frac{6}{8}$ dollars per ton?

Ans. $\$95\frac{1}{4}$.

CASE FIFTH.

Q. What is the fifth Case?

A. When it is required to *divide* by a mixed number.

Q. What is the RULE in this Case?

A. Multiply the *whole number* in the *divisor* by the *denominator* of its own fraction, and add in the numerator, for a *new divisor*: then multiply the *dividend* by the same *denominator* for a new dividend, divide, and the quotient will be the answer, and the remainder, if any, will be a numerator to your new *divisor*.

When the *dividend* is a mixed number, and the divisor is a mixed number, how do you divide?

By the *whole number* in the dividend, by the *denominator*.

inator of the fraction, and add in the *numerator* for a *new dividend*; then multiply the divisor by the *same* denominator, for a new divisor, divide, and the quotient will be the answer, and the remainder, if any, will be a numerator as before.

Q. How do you divide by a simple fraction, only, as $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, &c.

A. Multiply the dividend by the denominator of the fraction, and divide the product by the numerator, and the quotient will be the answer.

EXAMPLES.

$$\begin{array}{r} \text{(1)} \\ \text{Divide } 4846 \text{ by } 4\frac{1}{2} \\ \text{Operation } 4846 \\ \quad \quad \quad 2 \end{array}$$

$$4 \times 2 + 1 = 9 \quad 9692$$

$$\text{Ans. } 1076\frac{2}{3}$$

$$\begin{array}{r} \text{(3)} \\ \text{Divisor } 8\frac{2}{3} \overline{)9864} \end{array}$$

$$\text{Ans. } 1174\frac{2}{3}$$

$$\begin{array}{r} \text{(2)} \\ \text{Divide } 5670 \text{ by } 3\frac{1}{2} \\ \text{Operation } 5670 \\ \quad \quad \quad 3 \end{array}$$

$$3 \times 3 + 2 = 11 \quad 17010$$

$$\text{Ans. } 1546\frac{4}{11}$$

$$\begin{array}{r} \text{(4)} \\ \text{Divisor } 9\frac{1}{2} \overline{)12345} \end{array}$$

$$\text{Ans. } 1259\frac{34}{19}$$

5. What is the quotient of 273 divided by $3\frac{1}{2}$? *Ans.* 84.

6. What is the quotient of 1273 divided by $6\frac{1}{2}$? *Ans.* 201.

7. How many bags containing $3\frac{1}{2}$ bushels each can be filled from a bin of corn containing 497 bushels? *Ans.* 142 bags.

8. How many barrels of cider, each holding $31\frac{1}{2}$ gallons, can be filled from a cistern containing 567 gallons? *Ans.* 18.

9. A man purchased a section of land containing 25000 acres, and laid it out in squares of $25\frac{1}{2}$ acres each; how many squares were there? *Ans.* $980\frac{20}{11}$.

10. How many boxes are required to hold 400 lbs. of raisins, if each box contain $21\frac{1}{2}$ lbs? *Ans.* $18\frac{4}{11}$, or $\frac{202}{11}$.

PROMISCUOUS AND PRACTICAL QUESTIONS.

1. What must I give for 46 yards of broadcloth at $3\frac{1}{2}$ dollars a yard? *Ans.* 161 dollars.

2. What will 136 barrels of flour amount to at $8\frac{1}{2}$ dollars a barrel? *Ans.* 1122 dollars.

3. A farmer bought 237 acres of land at $14\frac{1}{2}$ dollars per acre; what was the whole cost? *Ans.* 3495 $\frac{1}{2}$ dol.

4. What must be given for 126 $\frac{1}{2}$ yards of broadcloth dollars per yard? *Ans.* 1138 $\frac{1}{2}$ d

5. A merchant bought 6 bales of cloth, each bale containing $14\frac{1}{2}$ pieces, and each piece $36\frac{1}{2}$ yards; how many yards in all?

Ans. $3153\frac{1}{2}$ yards.

6. If a ship and cargo be worth 25000 dollars, what is that man's share who owns $\frac{1}{5}$ of her?

Ans. 15625 dollars.

7. How many barrels, each containing $31\frac{1}{2}$ gallons, can be filled from 5 casks of cider, each cask holding $128\frac{1}{2}$ gallons?

Ans. 20 bbls. and $12\frac{1}{2}$ gallons.

8. If $5\frac{1}{2}$ yards make a rod, how many rods are there in 4575 yards?

Ans. 831 rods, $4\frac{1}{2}$ yards.

9. How many pounds of butter in 45 kegs, each keg containing $34\frac{1}{2}$ pounds?

Ans. 1552 $\frac{1}{2}$ lbs.

10. How many barrels containing $2\frac{1}{2}$ bushels each, can be filled from an apple-heap containing 154 bushels?

Ans. 56 barrels.

11. What must I give for $16\frac{1}{2}$ cwt. of cheese, at 7 dollars the cwt?

Ans. 115 $\frac{1}{2}$ dollars.

12. How many dollars will buy a farm containing 246 $\frac{1}{2}$ acres, at 15 dollars an acre?

Ans. 3701 $\frac{1}{2}$ dollars.

13. If I give $\frac{1}{3}$ of a dollar for 1 yard of ribbon, how much must I give for 12 pieces, each containing $27\frac{1}{2}$ yards?

Ans. $123\frac{1}{3}$ or $\frac{1}{3}$ dollars.

14. A merchant bought 4 parcels of coffee; the first contained 9 bags, each weighing $94\frac{1}{2}$ lbs.; the second contained 11 bags, weighing $104\frac{1}{2}$ lbs. each; the third, 12 bags, weighing $75\frac{1}{2}$ lbs. each; and the fourth, 8 bags, weighing $87\frac{1}{2}$ lbs. each; how many pounds in all?

Ans. 3602 lbs.

15. If a horse can trot $15\frac{1}{2}$ miles in an hour, how far will he go in $24\frac{1}{2}$ hours?

Ans. 385 $\frac{1}{2}$ miles.

16. A person has 3 barrels of cider, each containing $32\frac{1}{2}$ gallons; if he wishes to put it into kegs containing only $3\frac{1}{2}$ gallons each, how many kegs must he get?

Ans. $27\frac{1}{2}$ or 27 kegs, 3 gallons.

17. If 365 $\frac{1}{4}$ days make one year, how many days from the birth of Christ, to Christmas 1830?

Ans. 668407 $\frac{1}{4}$.

FEDERAL MONEY.

Q. What is understood by the term, Federal Money?

A. It is the coin and money of account of the United States.

Q. What are the denominations of this coin?

A. Eagles, dollars, dimes, cents and mills.

Q. In what proportion do these denominations increase from lower to the higher?

Ans. a tenfold proportion, like simple numbers.

Q. What do you mean by saying they increase in a tenfold proportion ?

A. I mean that 10 mills make 1 cent, marked C.
 10 cents " 1 dime, " d.
 10 dimes " 1 dollar, " D. or \$.
 10 dollars " 1 eagle, " E.

Q. What is the money unit, and how is it distinguished from the other denominations ?

A. The dollar is the money unit, and is separated from the smaller denominations by a point or comma, [,] called a separatrix: thus, \$ 4,65, means 4 dollars and 65 cents.

Q. How are the figures which denote the smaller denominations valued ?

A. According to the place they stand in from the dollars' place; that is, the first figure at the right hand of the separatrix, is dimes, the second is cents, and the third is mills;

Thus,	1 2 3	1 2 3	1 2 3
	d c m	d c m	d c m
	\$ 25,3 7 5	\$ 75,0 4 6	\$ 97,0 0 6

Q. When there are more than three figures at the right hand, what value do they possess ?

A. The fourth figure is 10ths of mills; the 5th, 100ths of mills, and so on.

Q. Is it necessary to separate the dimes, cents, and mills, from each other, by a separatrix ?

A. It is not. The dimes and cents may be read all cents: as, 9d. 5c. are the same as 95 cents; also, the dimes, cents, and mills, may be read all mills: as, 7d. 6c. 5m. are the same as 765 mills, or 76 cents, 5 mills.

Q. When the cents are less than ten, how must you write them ?

A. I must place a cipher in the first place or place of dimes: thus, .05 cents, or \$19,09 cents?

Q. How would you write down mills, if there were neither dimes nor cents ?

A. By placing *two* ciphers at the left hand of mills in the places of dimes and cents: thus, \$4,006.

Q. What do you mean by annexing or prefixing figures ?

A. To *annex* figures is to place them at the *right* hand: to *prefix* them is to place them at the *left* hand.

Q. How do you bring eagles to dollars, or dollars to dimes, cents, or mills ?

A. To bring eagles to dollars, annex *one* cipher; to bring dollars to dimes, annex *one* cipher; to bring dollars to cents, annex *two* ciphers; and to bring dollars to mills, annex *three*

ciphers: as, 9 eagles=\$90. \$75=750 dimes. \$75=7500 cents. \$75=75000 mills.

Q. What reason can you give for annexing ciphers in order to bring eagles to dollars, or dollars to dimes, cents, and mills?

A. Every cipher annexed to eagles or dollars, or to any sum, multiplies them by 10. Now as these denominations increase in a tenfold proportion, so multiplying any one denomination by 10 will bring it to the next lower; therefore, as 10 dimes make a dollar, 100 cents make a dollar, 1000 mills make a dollar, annex one cipher to dollars, or multiply them by 10, to bring them to dimes; annex two ciphers, or multiply them by 100, to bring them to cents; annex three ciphers, or multiply them by 1000, to bring them to mills.

Q. How will you bring dimes, cents, and mills, to dollars?

A. As dollars are brought to dimes, cents, and mills, by multiplying by 10, 100, 1000, these smaller denominations must be divided by the same numbers to bring them back again to dollars: therefore to bring dimes to dollars, divide them by 10, or cut off one right hand figure; to bring cents to dollars, divide them by 100, or cut off two right hand figures; and to bring mills to dollars, cut off three right hand figures; then those figures at the *left hand* of the *cut off* will be dollars; and those at the right hand will be dimes, cents, and mills.

EXAMPLES FOR MENTAL EXERCISE, SERIES I.

1. How many cents is $\frac{1}{2}$ of a dollar? *Ans. 50.*
2. How many cents are $\frac{3}{4}$ of a dollar? $\frac{1}{2}$? $\frac{1}{4}$? $\frac{3}{8}$? $\frac{5}{8}$? $\frac{7}{8}$?
3. How many cents is $\frac{1}{3}$ of a dollar? $\frac{2}{3}$? $\frac{1}{6}$? $\frac{5}{6}$?
4. How many cents is $\frac{1}{4}$ of a dollar? $\frac{3}{4}$? $\frac{1}{2}$?
5. How many cents is $\frac{1}{16}$ of a dollar? $\frac{3}{16}$? $\frac{5}{16}$? $\frac{7}{16}$? $\frac{9}{16}$? $\frac{11}{16}$? $\frac{13}{16}$? $\frac{15}{16}$?
6. John sold his top for $\frac{1}{2}$ of a dollar, and his sled for $\frac{1}{4}$ of a dollar; how many cents did he get for both?
7. What must I give for two bushels of corn, at $\frac{1}{2}$ of a dollar per bushel?
8. James had 9 dimes in his purse, and his father gave him 8 cents more: how many cents had he then? How many cents are 9 dimes, 8 dimes, and 7 dimes, added together?
9. What is the amount of 5 dimes, 5 cents, and 5 mills, added together?
10. What is the amount of 6 dollars, 6 dimes, 6 cents, and 6 mills?
11. What is the amount of 7 eagles, 7 dollars, 7 dimes, 7 cents, and 7 mills?
12. How many mills in 75 cents, and 6 mills?

13. How many mills in $\frac{1}{2}$ of a dollar ? In $\frac{3}{4}$?
14. How many cents in 750 mills ? In 875 mills ?
15. How many dollars in 500 eagles ? In 750 eagles ?
16. If I buy a horse for 6 eagles, and a cow for 20 dollars, how many dollars do I give for both ? How many dollars, added to 7 $\frac{1}{2}$ eagles, will make 100 dollars ?
17. John had 7 dimes in his pocket, and his father gave him cents enough to make him up a dollar ; how many cents did his father give him ?
18. One man paid me 5 half dollars, and another paid me 10 quarters of a dollar ; how many dollars had I then ?
19. What is the amount of 7 dimes and 80 cents, added together ?

SECOND SERIES OF MENTAL EXAMPLES.

1. Henry went to market and bought 3 pounds of butter at 12 $\frac{1}{2}$ cents a pound, and 2 $\frac{1}{2}$ pounds of meat at 10 cents a pound, and gave the man a dollar bill to take his pay from ; how much change did Henry receive back ?
2. A lady bought goods in a dry goods store to the amount of 3 dollars and $\frac{3}{4}$, and gave a 10 dollar bill to pay for them ; how much did she receive back in change ?
3. A man sold a horse for 7 $\frac{1}{2}$ eagles, and bought 3 cows at 20 dollars a head ; how many dollars had he left ?
4. Thomas sold his sled for $\frac{9}{10}$ of a dollar, and bought a knife for 37 $\frac{1}{2}$ cents ; how many cents had he left ?
5. How many dollars in 10 eagles ? How many dimes ? How many cents ? How many mills ?
6. How many cents are there in 100000 mills ? How many dimes ? How many dollars ? How many eagles ? How many half eagles ?
7. There are in a bag 100 silver dollars, 20 gold eagles, and 1000 ten cent pieces ; how many dollars in all ?
8. A man sold 2 bushels of corn at $\frac{5}{8}$ of a dollar the bushel, and 3 bushels of oats at $\frac{3}{4}$ of a dollar a bushel ; how much did the whole amount to ? If he spend $\frac{1}{2}$ of the money, what will be left ?
9. If 35 dollars be taken from 14 half eagles, how many dollars will be left ?
10. When flour is 6 $\frac{3}{4}$ dollars a barrel, what must you give for 2 barrels ? How much for 4 barrels ?
11. A man sold 4 barrels of flour at 6 $\frac{1}{2}$ dollars a barrel, and took his pay in ninepenny pieces ; how many pieces paid for the flour ?
12. How many cents are equal to $1\frac{9}{10}$ of a dollar ?

13. A man bought 2 sheep at $2\frac{1}{2}$ dollars a head, and 2 calves at $4\frac{3}{4}$ dollars a head ; what was the amount ?

14. Take $12\frac{1}{2}$ cents from 1 dollar, and what remains ? Take $37\frac{1}{2}$ cents, and what remains ? $62\frac{1}{2}$ cents ? $87\frac{1}{2}$ cents ?

THIRD SERIES OF MENTAL EXAMPLES.

1. What must be given for 4 barrels of flour at $6\frac{3}{4}$ dollars a barrel ? At $5\frac{3}{4}$ dollars a barrel ? At $7\frac{3}{4}$ dollars a barrel ?

2. When corn is $\frac{2}{3}$ of a dollar the bushel, what must I give for 8 bushels ? For 10 bushels ? For 12 bushels ?

3. If I buy 10 bushels of rye at 50 cents a bushel, how many bushels of oats must I sell at 25 cents a bushel, to pay for the rye ?

4. A man bought 12 yards of cloth at $4\frac{1}{2}$ dollars the yard ; how much will he make or lose, if he sells the whole for 50 dollars ?

5. Charles bought a peck of chesnuts at 8 cents a quart ; how many cents must he get for the peck to make 16 cents by the trade ?

6. A man bought 50 barrels of flour at 6 dollars a barrel, and sold it at $5\frac{1}{2}$ dollars a barrel ; how much did he lose on the whole ?

7. How many bushels of salt, at $1\frac{1}{2}$ dollars a bushel, will pay for 6 quintals of fish, at 3 dollars a quintal ?

8. Charles sold 24 cents worth of cherries, and after spending one half the money, laid the remainder out in oranges, at 3 cents a piece ; how many did he buy ? Divide one half of 24 by 3, and tell the quotient.

9. A man had 60 bushels of rye, at 1 dollar a bushel, which he exchanged for oats, at 25 cents a bushel ; how many oats would pay for the rye ?

10. What cost 8 yards of silk, at $1\frac{1}{2}$ dollars the yard ?

11. What will 9 yards of chintz cost, at $\frac{1}{3}$ of a dollar a yard ?

12. How many yards of cotton cloth, at $12\frac{1}{2}$ cents a yard, must be given for 25 yards of silk, at 50 cents a yard ?

13. What will 25 baskets of coal come to, at 20 cents a basket ?

14. If I buy a foot of wood for $\frac{1}{4}$ of a dollar, what must I give for a cord, at that rate ?

15. What must you give for 25 pounds of raisins, at 18 cents the pound ? At 16 cents ? at 12 cents ? at 9 cents ?

16. John bought 25 apples, at $1\frac{1}{2}$ cents a piece ; what did he pay for them ?

FOURTH SERIES OF MENTAL EXAMPLES.

1. How many apples at 2 for a cent, can you have for 3 oranges, worth 6 cents each ?

2. When wood is worth 6 dollars the cord, what must I give for 1 foot ? For 2 feet ? for 3 feet ? 4 feet ?

3. How many yards of tape, at $1\frac{1}{2}$ cents a yard, can be bought for $\frac{3}{4}$ of a dollar ?

4. A boy sold a dozen of eggs at $1\frac{1}{2}$ cents a piece, and laid out his money in oranges at 2 cents a piece; how many oranges did he buy ?

5. If a yard of cloth cost 4 dollars, how much can you buy for 1 dollar ? How much for 2 dollars ? 3 ? 4 ? 5 ? 6 ? 7 ? 8 ? 9 ? 10 ? 11 dollars ?

6. When flour is 8 dollars a barrel, how much can you buy for 1 dollar ? How much for 2 dollars ? for 3 dollars ? for 4 ? for 5 ? for 6 ? for 7 ? for 8 ? for 9 ? for 10 ? for 11 ? for 12 ?

7. If a bushel of corn cost $\frac{3}{4}$ of a dollar, what will half of a bushel cost ? What will 2 bushels cost ? 3 bushels ?

8. If a bushel cost $\frac{1}{2}$ of a dollar, what will half a bushel cost ? What will 1 peck cost ? What will $\frac{1}{2}$ a peck ?

9. If a bushel cost $\frac{9}{10}$ of a dollar, what will $\frac{1}{2}$ of a bushel cost ? What will $\frac{3}{4}$ of a bushel cost ? What will $\frac{1}{4}$ a bushel ?

10. If 2 bushels of oats cost $\frac{6}{8}$ of a dollar, what will one bushel cost ? What will $\frac{1}{2}$ a bushel cost ? What will a peck ?

11. How many barrels of flour, at $6\frac{1}{2}$ dollars a barrel, can you buy for 26 dollars ? For 39 dollars ? for 52 dollars ?

12. How many oranges, at $6\frac{1}{4}$ cents a piece, can you buy for 100 cents ? For 75 cents ? for $62\frac{1}{2}$ cents ? for $37\frac{1}{2}$ cents ?

13. A market woman sold 12 dozens of eggs at $12\frac{1}{2}$ cents a dozen, and laid out the amount in tea, at $\frac{2}{3}$ of a dollar the pound; how much tea could she buy ?

14. A man sold 8 bushels of corn, at $\frac{6}{8}$ of a dollar a bushel, and bought 8 bushels of oats at $\frac{3}{4}$ of a dollar a bushel; how much money had he left ?

15. A boy was sent to market with 2 dollars and 50 cents, to buy butter; he found some at $12\frac{1}{2}$ cents a pound; how many pounds could he buy ?

COMPOUND ADDITION.

Q. What is Compound Addition ?

A. It is adding together numbers of different denominations, dollars, cents, and mills; tons, hundreds, quarters; shillings, pence, &c.

F*

FEDERAL MONEY.

Q. What is the Rule for Addition of Federal Money ?

A. Write dollars under dollars, dimes under dimes, cents under cents, &c., and add them precisely as in whole numbers; then place the separatrix, in the sum total, exactly under the separating points above.

EXAMPLES FOR EXERCISE ON THE SLATE.

(1)	(2)	(3)
d. c. m.	d. c. m.	d. c. m.
Add 375,463	Add 241,246	Add 956,217
294,875	131,064	43,06
136,562	328,887	21,313
321,553	215,120	114,270
500,206	726,543	64,106
314,213	201,568	28,29

N. B.—That the scholar may learn to exercise his own judgment in pointing off his sums, I have given the figures only, which compose the following answers, without any separatrix, and in some instances I have thought it better to give no answer.

4. Add together the following sums, viz. 246 dollars and eight cents, 394 dollars and 70 cents, 183 dollars and 7 cents, 1231 dollars and 60 cents, and 74 dollars and 9 cents. *Ans.* 212954.

5. A merchant sold to his customers 5 yards of silk for 5 dollars and 9 cents, 6 yards of broadcloth for 15 dollars and 90 cents, 8 yards of calico for 2 dollars and 5 dimes, 9 yards of lace for 7 dollars and 50 cents, and 67 yards of ribbon for 75 cents and 5 mills; what was the amount of the whole bill ?

Ans. 31745.

6. A butcher bought 5 fat oxen: for the first he gave 37 dollars, for the second 45 dollars and fifty cents, for the third 39 dollars and five cents, for the fourth 28 dollars and nine mills, and for the fifth 37 dollars, five dimes, five cents, and five mills; how much did he give for the whole ? *Ans.* 187114.

7. Add together the following sums, viz. 467 dollars 93 cents, 75 dollars 87 cents, one mill, 137 dollars forty cents, 390 dollars, 87 cents, 4 mills, and 1246 dollars, 87 cents, 3 mills.

Ans. 2318948.

Q. What is the amount of 900 dollars, 900 dimes, 900 cents, *mills*, added together ?

A. Is the amount of 999999 dollars, 888888 dimes, 777777 cents, and 666666 mills, added together ?

10. A school boy bought a knife for 25 cents, a slate for 16 cents, a spelling book for 31 cents, a grammar for 33 cents, an arithmetic for 50 cents, a geography for 75 cents, and a writing book for 12 cents; how many dollars and cents did the whole cost?

Ans. 242.

11. A farmer sold a yoke of oxen for \$62,50 cents; a span of horses for \$150; two cows for \$25 and six dimes each, and 3 fat sheep for \$2 and eight cents each; what was the whole amount?

Ans. 26994.

12. A banker had 5 bags of money, the first containing 500 eagles; the second 675 dollars; the third 2500 ten cent pieces; the fourth 1786 cents; and the fifth contained 75 eagles, 100 dollars, 250 dimes, and 350 cents; can you tell the amount of money in the whole?

Ans. 682136.

13. Add 37 ten cent pieces, 156 dimes, and 600 mills together.

CASE SECOND.

Q. Is it common, in business transactions, to make any use of mills in casting accounts?

A. It is not: we have no coin to represent mills; they are merely *nominal*.

Q. Is their use *ever* necessary?

A. It is when great accuracy in casting is required, and therefore they should be well understood.

Q. How do you reckon even parts of a cent if you make no use of mills in casting accounts?

A. The more common way is to reckon them by halves and quarters; as, \$2,37½, \$3,18¼, \$5,62½, \$6,87½.

Q. What is the *RULE* for adding halves and quarters of cents, or of any other denomination?

A. Add together the number of quarters (calling every ½ two quarters) and divide their sum by 4, to see how many wholes are contained in it: if there remain any *odd* quarters, set them down under the quarters in the given sum, and carry the number of wholes contained in all the quarters to the first left hand figure, and then proceed as usual.

EXAMPLES.

1. A boy in a store sold 1 lb. of sugar for 12½ cents; 1 gallon of molasses for 37½ cents; 1 lb. of souchong tea for 62½ cents; 1 lb. of Hyson tea for 87½ cents; 1 bushel of salt for \$1,12½; and 2 bushels of beans for 62½ cents per bushel: his father being absent he could not tell the amount; had

been there could you have told him? then you may tell me.

Ans. 437½.

2. A farmer carrying his produce to market, sold his pork for \$37,62½, his cheese for \$25,18½, his butter for \$17,37½, his oats for \$5,31½, and his beans for \$4,6½ cents; how much money did he receive?

Ans. 8956½.

3. A market-boy sold his apples for 145 cents, his pears for 75 cents, his peaches for 225 cents, his cherries for 62½ cents, his plums for 37½ cents, besides 2 water melons for 18½ cents each; how many dollars did the boy get for his fruit?

Ans. 582½.

4. A gentleman bought a hat for 650 cents, a pair of boots for 537½ cents, one pair of shoes for 218½ cents, a broadcloth coat for \$19,62½, a watch for \$37,31½, and 2 pair of silk stockings at 125 cents a pair; what was the amount of his bill?

Ans. 7350 cents.

5. My expenses for the last year were as follows, viz. provisions \$150,62½, wood \$45,87½, clothing \$118,12½, house rent \$125,37½, store rent \$175,62½, paid insurance on store and goods \$50,75, besides losing my pocket-book containing 2 fifty dollar bills, and one dollar and sixty-two and a half cents in change; what was the amount of all my expenses including my loss?

Ans. 76800 cents.

6. What is the amount of 9 dimes, 8 dimes, 7 dimes; 9 cents, 8 cents, 7 cents; and 9 mills, 8 mills, and 7 mills, added together?

Ans.

7. A lady bought in a store 8 yards of chintz for 2 dollars and 50 cents, 2 yards of lace for 62½ cents a yard, 1 pair of silk stockings for 1 dollar and 8 cents, 2 pair of gloves at 87½ cents a pair, and a merino shawl for \$8,62½; what was the amount of the bill?

Ans. 1520½ cents.

8. In 320 dimes, 465 cents, and 14000 mills, how many dollars, cents, &c.

Ans.

9. A merchant bought sundry goods amounting as follows, viz.: broadcloths amounting to 237½ dollars, cassimeres for 175½ dollars, silks for \$146,62½ cents, calicoes for \$247,87½ cents, and other articles amounting to \$237,31½ cents; what was the whole amount?

Ans. \$1044,56½ cents.

STERLING MONEY.

Q. What is to be understood by Sterling Money?

A. Sterling Money is the money of account in Great-Britain, and consists of pounds, shillings, pence, and farthings.

Q. In what proportion do the denominations of sterling from the lower to the higher?

COMPOUND ADDITION.

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A. These, and also the denominations of the weights and measures increase in varied and irregular proportions.

Q. Can you repeat the relative proportion that the denominations of sterling money bear to each other?

A. 4 farthings make 1 penny, marked d.
 12 pence " 1 shilling, " s.
 20 shillings " 1 pound, " £, or l.

Q. Are there not other denominations of money that occur in mercantile transactions?

A. There are.

Q. What are the relative values of some of the different coins?

	s.d.	\$ cts.
1 Groat is equal to	0,4	0,05
1 French livre	1,1½	0,18½
1 Dutch guilder	2,4	0,40
1 Ruble of Russia	4,0	0,66
1 French 5 franc piece	5,6	0,93
1 Spanish dollar	6,0	1,00
1 English or French crown	6,8	1,10
1 Tale of China	8,10½	1,48
1 Pagoda of China	11,8	1,94
1 French guinea	21,0	3,50
1 Pistole	22,0	3,66
1 French Louis d'or	1l. sterling of Eng.	4,44½
1 English guinea	28,0	4,66
1 Moldore	36,0	6,00
1 Joanesse or half Johanna	48,0	8,00
1 Doublon	88,0	14,66
1 Double Joanesse, or 1 Johanna	96,0	16,00

TROY WEIGHT.

Q. What articles are weighed by this weight?

A. Gold, silver, jewels, and all kinds of liquors.

Q. What are the denominations used?

A. Pounds, ounces, pennyweights and grains.

Q. Can you repeat the table?

A. 24 grains (grs.) make 1 pennyweight, marked pwt.
 20 pennyweights " 1 ounce, " oz.
 12 ounces " 1 pound, " lb.

AVOIRDUPOIS WEIGHT.

Q. What goods are weighed by this weight?

A. All goods of a coarse and drossy nature, as tea, sugar, coffee, flour, tallow, hides, leather, hay, and all kinds of metals, except gold and silver.

Q. What are the denominations used ?

A. Tons, hundreds, quarters, pounds, ounces, and drams.

Q. Can you repeat the table ?

A. 16 drams (dr.)	make 1 ounce	marked oz.
16 ounces	" 1 pound,	" lb.
28 pounds	" 1 quarter of a hund. weight,	qr.
4 quarters	" 1 hundred weight, gross,	cwt.
20 hundreds	" 1 ton,	" T.

Q. Are coarse goods now weighed in buying and selling by gross weight, or 112 lbs. for a cwt. as formerly ?

A. They are not : the merchants in all the principal towns and cities in the United States, now buy and sell by neat hundreds, or 100 lbs. for a cwt., and 2000 lbs. for a ton.

APOTHECARIES' WEIGHT.

Q. What use is made of this weight ?

A. It is used by druggists and physicians in compounding medicines.

Q. Do they buy and sell their articles by this weight ?

A. They do not : their goods are bought and sold by Avoirdupois weight.

Q. What are the denominations used ?

A. Pounds, ounces, drams, scruples, and grains.

Q. Can you repeat the table ?

A. 20 grains (gr.)	make 1 scruple, marked sc. or	3
3 scruples	" 1 dram,	" dr. 3
8 drams	" 1 ounce,	" oz. 3
12 ounces	" 1 pound,	" lb. 16

CLOTH MEASURE.

Q. What use is made of Cloth Measure ?

A. Cloth, and all articles are measured by it which are bought and sold by the yard or ell.

Q. What are the denominations used ?

A. Ells, yards, quarters, and nails.

Q. Can you repeat the table ?

A. 4 nails (na.)	make 1 quarter,	marked qr.
4 quarters	" 1 yard.	" yd.
3 quarters	" 1 Ell Flemish,	" E. Fl.
5 quarters	" 1 Ell English,	" E. E.
6 quarters	" 1 Ell French,	" E. Fr.

LONG MEASURE.

Q: What use is made of this measure ?

*It is used in measuring distances or other things, where
' is con without regard to breadth or thickness.*

Q. What are the denominations used?

A. Degrees, leagues, miles, furlongs, rods, yards, feet, inches, and barley corns.

Q. Can you repeat the table?

A. 3 barley corns (b. c.) make 1 inch, marked in.
 12 inches " 1 foot, " ft.
 3 feet " 1 yard, " yd.
 5½ yards or 16½ feet " 1 rd. pole or perch rd. or p.
 40 rods or 220 yards " 1 furlong, " fur.
 8 furlongs or 320 rods " 1 mile, " m.
 3 miles " 1 league, " l.
 60 geographical or 69½ st. miles 1 degree, " deg.
 360 degrees make a great circle or circumference of the earth.

WINE MEASURE.

Q. What articles are measured by Wine Measure.

A. All kinds of spirituous liquors except ale, beer, vinegar, cider, &c.

Q. What are the denominations used?

A. Tons, pipes, hogsheads, tierces, barrels, gallons, quarts, pints, and gills.

Q. What is the table?

A. 4 gills (gi.) make 1 pint, marked pt.
 2 pints " 1 quart, " qt.
 4 quarts " 1 gallon, " gal.
 31½ gallons " 1 barrel, " bbl.
 42 gallons " 1 tierce, " tierc.
 63 gallons " 1 hogshead, " hhd.
 2 hhds. or 126 gals. 1 pipe, " p.
 2 pipes or 4 hhds. 1 ton, " T.

Q. Are the dimensions of the different casks, as pipes, hogsheads, tierces, &c. as given in the table, the same as those used by merchants in importing and exporting liquors?

A. They are not: there is no nation with whom the United States have any commerce, from whom they import liquors in casks of the size of those given in the table.

Q. What is the usual size of pipes?

A. They gauge from 110 to 140 gallons.

Q. What is the usual size of a hogshead?

A. From 90 to 136 gallons.

Q. How much do tierces usually contain?

A. From 40 to 70 or 80 gallons.

Q. What is the common size of barrels?

A. From 28 to 40 gallons.

Q. If pipes and hogsheads are so nearly of a size, how are they distinguished from each other?

A. They differ in shape. Pipes are made longer, with a smaller circumference, than hogsheads which contain the same number of gallons.

Q. What articles are imported in pipes?

A. Wine, brandy, and gin. Wine is also imported in tierces, and quarter casks, or barrels.

Q. What are imported in hogsheads?

A. Rum and molasses. Molasses is also imported in barrels.

CIRCULAR MOTION.

Q. What do you understand by Circular Motion?

A. The motion of the earth and of the heavenly bodies.

Q. In what respect are the denominations of circular motion adapted to the motions of the earth and heavenly bodies?

A. They are used to divide the orbits of the planets, and the geographical circles that surround the earth.

Q. What are the denominations?

A. Signs, degrees, minutes, and seconds.

Q. What is the table?

A. 60 seconds (") make 1 minute, marked '
 60 minutes " 1 degree, " °
 30 degrees " 1 sign, " S
 12 signs, or 360 degrees, make the great circle of the zodiac.

LAND, OR SQUARE MEASURE.

Q. What use is made of this measure?

A. It is used in measuring land, and any other things where length and breadth are considered.

Q. What are the denominations used?

A. Miles, acres, roods, rods, yards, feet and inches.

Q. What is the table?

A. 144 square inches make 1 square foot, marked sq. ft.
 9 " feet " 1 " yard, " sq. yd.
 30½ " yards " 1 " rod, " sq. rd.
 40 " rods " 1 " rood, " sq. rd.
 4 " roods " 1 " acre, " sq. ac.
 640 " acres " 1 " mile " sq. mi.

SOLID, OR CUBIC MEASURE.

Q. What use is made of this measure?

A. It is used in measuring things that have length, breadth, and thickness; as timber, wood, stones, bales of goods, &c.

Q. What are the denominations used ?

A. Cords, tons, yards, feet, and inches.

Q. What is the table ?

A. 1728 solid inches, that is, 12 inches in length, 12 in breadth, and 12 in depth, make 1 solid foot.

27 solid feet make 1 solid yard.

40 feet of round timber, or } make 1 ton or load.

50 feet of hewn timber, }

30 feet make 1 cord of stone.

128 solid feet, that is, 8 feet long, } make 1 cord of wood.

4 feet wide, and 4 high, }

TIME.

Q. Into what denominations is Time divided ?

A. Years, months, weeks, days, hours, minutes, and seconds.

Q. What is the table ?

A. 60 seconds (sec.) make 1 minute, marked m.

60 minutes " 1 hour, " h.

24 hours " 1 day, " d.

7 days " 1 week, " w.

4 weeks " 1 lunar month " mo.

{ 13 lunar months, 1 day and 6 hours { 1 common or

{ 12 calender months { Julian year.

365½ days, or 365 days, 6 hours, make 1 year, marked yr.

100 years make 1 century, " cen.

Thirty days hath September, February hath twenty-eight,
April, June, and November; And thirty-one the others rate.

Every fourth year is Leap Year, in which February has 29 days. Whenever the year of our Lord can be divided by 4, without a remainder, it is leap year.

DRY MEASURE.

Q. What articles are measured by this measure ?

A. All kinds of grain, together with fruits, salt, coal, &c.

Q. What are the denominations used ?

A. Chaldrons, bushels, pecks, quarts, and pints.

Q. What is the table ?

A. 2 pints (pts.) make 1 quart, marked qt.

8 quarts " 1 peck, " pk.

4 pecks " 1 bushel, " bush

36 bushels " 1 chaldron, " ch

N.B.—A bushel is 18½ inches in diameter, and deep, and contains 2150½ solid inches.

COMPOUND ADDITION.

TABLE OF MISCELLANEOUS PARTICULARS.

12 single things	make	1	dozen, marked doz.
12 dozen	"	1	single gross.
12 gross or 144 doz.	"	1	great gross.
20 single things	"	1	score.
5 score	"	1	hundred.
24 sheets of paper	"	1	quire.
20 quires	"	1	ream.
6 points	"	1	line, } used in measuring the
12 lines	"	1	inch, } pendulums of clocks.
4 inches	"	1	hand, } used in measuring the
			height of horses.
6 feet	"	1	fathom } used in measuring
			depths at sea.
112 pounds	"	1	quintal.
196 "	"	1	barrel of flour.
200 "	"	1	barrel of beef, pork, or fish.
50 "	"	1	bushel of rye meal.
50 "	"	1	bushel of Indian meal.

Q. What is the RULE for addition of sterling money, weights, and measures?

A. Place the several denominations so that those of the same name may stand directly under each other: add the first or least denomination together, as in simple addition, and divide the sum by as many of *this* denomination as will make *one* of the *next* greater; set down the remainder, under the column added, and carry the quotient to the next greater denomination, which add and divide on the same principle as before, and thus continue through all the denominations, till you come to the last, which add and set down as in simple addition.

EXAMPLES.

	(1)				(2)				(3)			
	£	s.	d.	qrs.	£	s.	d.	qrs.	s.	d.	qrs.	
Add	237	13	6	$\frac{1}{2}$	123	19	11	$\frac{1}{4}$	19	8	$\frac{1}{2}$	
	118	14	9	$\frac{1}{4}$	234	14	9	$\frac{1}{2}$	17	6	$\frac{1}{4}$	
	237	15	8	$\frac{1}{2}$	345	17	6	$\frac{1}{4}$	14	5	$\frac{1}{4}$	
	198	16	10	$\frac{1}{2}$	456	13	3	$\frac{1}{2}$	16	7	$\frac{1}{2}$	
	349	17	4	$\frac{1}{4}$	567	15	8	$\frac{1}{4}$	18	6	$\frac{1}{4}$	

R.—The teacher will take notice, that, in Compound & of the true answer is given in the

book: consequently the scholar, to prove whether his *own work* be right or not, must add his answer to itself, and if that sum agree with the answer given in the book, his work will be right. This is done to prevent thoughtless scholars from taking advantage of the answer given in the book (as is too often the case) to make their own come right, without properly understanding how it is obtained.

4. A merchant received from his agent in England, an invoice of 4 packages of goods; the first, amounting to £247 13s. 6½d.; the second, to £314, 17s. 9½d.; the third, to £98, 15s. 8½d.; and the fourth, to £1237, 18s. 6½d.; what was the amount of the invoice? $Ans. \times 2 = £3798, 11s. 2d.$

5. An ignorant boy in a hardware store, sold 1 dozen pen-knives for 15s. 6d.; 2 dozen of doorlocks for 18s. 9½d. a dozen; 1 case of knives and forks for 9s. 4½d.; 1 gross of buttons for 17s. 6½d.; and not being able to tell the amount, was obliged to charge them; can you tell me the amount of the bill?

$Ans. \times 2 = £8.$

TROY WEIGHT.

	(1)				(2)				(3)			
	lb.	oz.	pwt.	gr.	lb.	oz.	pwt.	gr.	oz.	pwt.	gr.	
Add	37	8	14	8	131	10	16	22	11	8	16	
	29	5	15	21	312	11	13	15	10	9	14	
	16	4	16	20	471	10	18	19	9	7	15	
	13	2	17	19	36	9	19	20	8	10	13	
	216	9	12	15	115	3	13	23	7	9	18	

4. A silversmith sold a silver teapot, weighing 8 oz. 14 pwt. 16 gr.; a sugar bowl, weighing 4 oz. 13 pwt. 19 grs.; six table spoons, 8 oz. 17 pwt. 21 gr.; and one dozen tea spoons, 7 oz. 12 pwt. 10 gr.; what was the whole weight?

$Ans. \times 2 = 4 \text{ lb. } 11 \text{ oz. } 17 \text{ pwt. } 12 \text{ gr.}$

5. A refiner sold 4 ingots of silver, weighing, No. 1, 6 oz. 13 pwt. 10 grs.; No. 2, 5 oz. 18 pwt. 21 grs.; No. 3, 7 oz. 4 pwt. 8 grs.; No. 4, 4 oz. 16 pwt. 23 grs.; what was the whole weight?

$Ans. \times 2 = 4 \text{ lb. } 1 \text{ oz. } 7 \text{ pwt. } 4 \text{ grs.}$

6. A jeweller sold by weight, 1 elegant pair of ear ornaments, weighing 6 pwts. 13 grs.; 1 pair of bracelets, 1 oz. 13 pwt. 14 grs.; a gold chain, 2 oz. 8 pwt. 17 grs.; and a large diamond brooch pin, weighing 17 pwt. 14 grs.; what was the weight?

$Ans. \times 2 = 10 \text{ oz. } 12 \text{ pwt. } 20 \text{ grs.}$

COMPOUND ADDITION.

AVOIRDUPOIS WEIGHT.

(1)					(2)					(3)	
T.	cwt.	qrs.	lbs.	oz.	T.	cwt.	qrs.	lbs.	oz.	dr.	lbs. oz.
7	14	2	14	11	18	14	2	17	10	13	16 13 $\frac{1}{2}$
6	15	1	17	12	21	13	0	16	12	14	15 12 $\frac{1}{2}$
9	17	3	19	9	12	16	1	13	14	12	18 10 $\frac{1}{2}$
8	13	2	18	8	18	17	3	15	10	6	21 9 $\frac{1}{2}$
5	11	3	16	10	29	19	1	16	13	13	71 7 $\frac{1}{2}$

4. A vessel arrived laden with Lehigh and Peach Orchard coal, and the master sold to A. 14 tons, 7 $\frac{1}{2}$ cwt.; to B. 25 tons, 18 $\frac{1}{2}$ cwt.; to C. 18 tons, 15 $\frac{1}{2}$ cwt.; to D. 37 tons, 16 $\frac{1}{2}$ cwt.; and to E. 50 tons, 18 $\frac{1}{2}$ cwt.; how much did all that was sold weigh?

Ans. $\times 2 = 295$ tons, 13 cwt.

5. A merchant bought 4 boxes Havana brown sugar, weighing, No. 1, 4 cwt. 0 qrs. 17 lbs.; No. 2, 3 cwt. 3 qrs. 18 lbs.; No. 3, 4 cwt. 0 qrs. 17 lbs.; No. 4, 3 cwt. 3 qrs. 24 lbs.; what was the whole weight?

Ans. $\times 2 = 32$ cwt. 1 qr. 12 lbs.

APOTHECARIES WEIGHT.

(1)					(2)					(3)		
lbs.	oz.	dr.	sc.	grs.	lbs.	oz.	dr.	sc.	grs.	dr.	sc.	grs.
75	10	7	2	18	123	11	7	2	19	6	1	13
46	8	6	1	17	213	10	6	2	18	5	2	12
23	11	5	0	16	321	9	5	1	17	1	0	16
32	9	4	2	15	231	8	4	0	16	5	2	15
64	7	3	1	14	132	7	2	2	15	2	1	11

4. A druggist, in compounding a certain specific, made use of 5 different ingredients, in the quantities following, viz: of the first, 3 lbs. 8 oz. 6 drs. 1 sc. 14 grs.; of the second, 5 lbs. 7 oz. 5 drs. 2 sc.; of the third, 6 lbs. 5 oz. 6 drs.; of the fourth, 2 lbs. 9 oz. 4 drs. 2 sc. 16 grs.; and of the fifth, 7 lbs. 7 oz. 7 drs. 19 grs.; what was the whole weight of the compound?

Ans. $\times 2 = 52$ lbs. 7 oz. 4 drs. 2 sc. 18 grs.

CLOTH MEASURE.

(1)			(2)			(3)		
E.	Fr.	qrs. na.	E.	E.	qrs. na.	yds.	qrs.	na.
147	5	3	121	4	1	146	3	3
218	4	2	211	3	2	416	2	2
104	3	1	112	2	3	614	3	1
321	0	3	346	3	0	416	2	3
			412	3	3	641	0	0

4. Bought 5 pieces of Flemish lace, containing as follows, viz: No. 1, 14 ells, 2 qrs. 3 na.; No. 2, 13 ells, 1 qr. 2 na.; No. 3, 21 ells, 2 qrs. 1 na.; No. 4, 12 ells, 0 qrs. 3 na.; No. 5, 10 ells, 1 qr. 2 na.; how many ells, quarters, and nails, in the whole? *Ans.* $\times 2 = 145$ ells, 2 qrs. 2 nails.

5. How many yards are there in a package of goods, invoiced as follows, viz:

No.	Yds.	No.	Yds.	No.	Yds.	No.	Yds.
1	36½	7	39½	13	26	19	32½
2	35½	8	18½	14	37½	20	23½
3	28½	9	24½	15	29½	21	35½
4	37½	10	38½	16	34	22	40½
5	29½	11	41½	17	38½	23	38½
6	30½	12	38½	18	26½	24	31½

Ans. $\times 2 = 1584$ yards.

A MISCELLANEOUS COLLECTION OF QUESTIONS, BRINGING INTO PRACTICE MOST OF THE COMPOUND NUMBERS.

1. A merchant bought 4 boxes of sugar, each weighing 4 cwt. 2 qrs. 14 lbs., for which he paid 37 dollars a box; what was the whole weight, and what did the sugar amount to?

Ans. { Whole wt. $\times 2 = 37$ cwt.
Amount $\times 2 = \$296$.

2. A gentleman bought 4 lots of land, quantities and costs as follows, viz: the first lot, 14 acres, 2 roods, 35 rods, for £27 13s. 8d.; the second lot, 25 acres, 1 rood, 19 rods, for £37 10s.; the third lot, 39 acres, 3 roods, 25 rods, for £50 16s. 9d.; the fourth lot, 28 acres, 0 roods, 27 rods, for £47 12s. 9d. How many acres did the 4 lots contain, and how much did he pay for the whole?

Ans. { No. of acres $\times 2 = 216$ a. 52 rds.
Whole cost $\times 2 = £327$. 6s. 4d.

3. A merchant bought 4 parcels of wine; the first, containing 4 pipes, 1 hhd. 27 gals. 3 qts.; the second, 5 pipes, 0 hhds. 57 gals. 2 qts.; the third, 6 pipes, 1 hhd. 37 gals. 1 qt., and the fourth, 3 pipes, 1 hhd. 49 gals. 3 qts.; how much in the whole?

Ans. $\times 2 = 41$ pipes, 1 hhd. 29 gals. 2 qts.

4. A farmer carried 5 bags of corn to market; the first held 3 bu. 3 pks. 6 qts.; the second, 4 bu. 1 pk. 5 qts.; the third, 3 bu. 2 pks. 7 qts.; the fourth, 4 bu. 5 qts.; and the fifth, 3 bu. 1 pk. 6 qts.; how much corn had he to sell?

Ans. $\times 2 = 39$ bu. 1 pk. 2 qts.

5. A man had 5 sons who lived to the following ages: the eldest lived 75 years, 146 days, 13 hours, 40 min; the second, 82 years, 224 days, 18 hours, 5 min

third, 69 years, 150 days, 19 hours, 17 minutes; the fourth, 79 years, 287 days, 15 hours, 56 minutes; and the fifth, 87 years, 327 days, 21 hours, 37 minutes; what was the amount of all their ages? *Ans.* $\times 2 = 790$ yrs. 85 dys. 9 hs. 10 m.

6. How many square feet are contained in 4 boards, the first, containing 17 feet, 122 inches; the second, 14 feet, 114 inches; the third, 13 feet, 83 inches; and the fourth, 12 feet, 127 inches? *Ans.* $\times 2 = 118$ feet, 28 inches.

7. A ship, sailing for Europe, sailed the first day, $3^{\circ} 45' 47''$; the second day, $4^{\circ} 19' 50''$; the third day, $3^{\circ} 45' 35''$; the fourth day, $5^{\circ} 19' 27''$; and the fifth day, $4^{\circ} 38' 56''$; what was her distance from port, after 5 days' sailing? *Ans.* $\times 2 = 43^{\circ} 39' 10''$.

8. A teamster carted 4 loads of stone for a cellar wall; the first contained 1 cord, 25 feet; the second, 2 cords, 14 feet; the third, 1 cord, 20 feet; and the fourth, 2 cords, 28 feet; how many cords and feet in the 4 loads? *Ans.* $\times 2 = 17$ cords, 24 ft.

9. Three apples were placed 120 yds. 2 ft. 9 in. 2 b. c. from each other, and a basket placed 217 yds. 2 ft. 6 in. from the last apple; how far did the boy travel, who started from the basket and picked up the apples, returning with them, one by one, to the basket? *Ans.* $\times 2 = 4065$ yds. 0 ft. 8 in.

10. A merchant handed to his clerk the following invoice of 20 kegs of butter, wishing him to find the gross weight, the nett weight, (after allowing 4 pounds for each keg,) and the amount of it at 16 cents per pound?

No. 1, 27½	No. 6, 31½	No. 11, 23½	No. 16, 31½
2, 28½	7, 27½	12, 24½	17, 32½
3, 24½	8, 32½	13, 29½	18, 28½
4, 26½	9, 29½	14, 26½	19, 27½
5, 28½	10, 27½	15, 28½	20, 29½

{ Whole gross wt. $\times 2 = 1131$ lbs.
 { Whole nett wt. $\times 2 = 971$ lbs.
 { Amount $\times 2 = \$155.36$ cts.

COMPOUND SUBTRACTION.

Q. What is Compound Subtraction?

A. It is taking one sum or number from another of different *minutions*, as dollars, cents, and mills; yards, quarters, acres, roods, rods, &c.

FEDERAL MONEY. *

Q. What is the RULE for subtraction of Federal Money?

A. Place dollars under dollars, dimes under dimes, cents under cents, &c. and proceed precisely as in simple subtraction, observing to place the separatrix, directly under the separating points in the given sums.

Q. Should there be cents, or cents and mills in the subtrahend, and none in the minuend, how do you proceed?

A. Take the lower figure from ten, and carry one to the next figure, as usual.

Q. If there be halves or quarters of cents in the given sums, how do you subtract them?

A. Take the quarters in the lower line, from the quarters in the upper line, and set down the remaining ones underneath; but if the quarters in the lower line *exceed* those in the upper, subtract them from four, and to the difference, add the upper quarters, remembering to carry *one* to the next left hand figure, and proceed on as usual.

EXAMPLES.

(1)	(2)	(3)
\$ c. m.	\$ c. m.	\$ c. m.
From 463 473	From 146 873	From 5723 47
Take 176 563	Take 97 985	Take 296 156
(4)	(5)	(6)
From 906 47	From 1406 62½	From 8766 31½
Take 392 37½	Take 378 31½	Take 953 62½

7. From one hundred thousand dollars, take 888,888 cents, and tell me how much remains.

8. If a farmer's whole estate be worth 3760 dollars, and his debts amount to \$1876,62½, how much will remain after he has paid his debts?

Ans. \$1883,37½ cts.

9. A poor boy found a purse, containing \$9,62½, and finding no owner, bought him a hat for \$1,25, a pair of shoes for \$1,37½, a waistcoat for 87½ cents, and a load of wood for his mother, which cost \$3,62½; how much money had he left?

Ans. 2,50 cts.

10. A father, dying, left an estate to his son, worth \$25000; but out of it he was obliged to pay three notes of his father's—*one* to A. of \$137,87½, one to B. of \$218,62½, one to C. of \$5860,37½, besides the expenses of a lawsuit in settling

estate, amounting to \$750,37½; how much remained after settling all demands? *Ans.* \$18032,75.

11. A market-woman sold her eggs for 75 cents, her peaches for 90 cents, her pears for \$1,87½, and her plums for 62½ cents; besides \$2,31½ she had in her purse; she spent out of it \$4,50; how much money did she carry home?

Ans. \$1,96½ cents.

12. From one million of dollars, take 999999 dimes, and how much remains?

13. A thief stole from a banker, a bag containing 500 eagles, out of which, he bought a suit of clothes for \$75,50, a hat and a pair of boots for \$12,75, a carriage and horses for \$1,50, besides settling an execution of \$475,62½, before he could leave the place; he was then detected, and the residue taken and restored to the rightful owner; how much did the banker get back?

Ans. \$4070,25.

14. A boy in a store sold 1 yard of lace for \$2,37½, 1 piece of domestic cotton for \$1,62½, 6 yards of chintz for \$1,50, and ribbon for 87½ cents; the purchaser gave him a ten dollar bill to pay for them; how much change did the boy give him back?

Ans. \$3,62½ cts.

15. The President of the United States receives a salary of 25000 dollars a year; how much can he spend, and lay up 6746 dollars and 62½ cents a year?

Ans. \$18253,37½.

16. What sum, added to \$46287,45½ will make \$100000?

17. A banker had 4 bags of money; the first contained 500 eagles, the second 750 dollars, the third 2475 ten cent pieces, and the fourth contained 350 dollars, 1235 dimes, besides 450 cents; out of which he paid a note of \$5765,87½; can you tell how much he had left?

Ans. \$709,62½ cts.

18. A lady bought in a dry goods store, 1 pair of silk hose for \$1,37½; 2 pair of cotton hose for 62½ cents a pair; 1 piece of crape for \$7,62½, and a silk shawl for \$3,87½; how much change did she receive, out of 15 dollars, which she handed the merchant?

Ans. 87½ cts.

19. A farmer bought a yoke of oxen and a span of horses for \$375,50; he soon after sold one of his horses for \$125,62½, and the oxen for \$65,75; how much must he get for the other horse, to make \$50 by his bargain?

Ans. \$234,12½ cts.

20. Take 37½ cents from one dollar, and how much remains?

21. Take 1,62½ from \$3,00, and how much remains?

22. Take \$2,18½ from \$5, and what remains?

from \$10, and what remains?

ts from \$32,00, and what remains?

mult of \$25,50 + 37½ cts. + \$46,62½ = \$50

½ + \$75,25 = \$111,43½.

Ans. 0.

STERLING MONEY.

Q. What is the RULE for subtraction of Sterling Money, Weights, and Measures ?

A. Place the less sum under the greater, so that those of the same denomination may stand directly under each other; begin with the lowest denomination, and if the lower number be greater than the upper one, borrow as many units of *that* denomination as make one of the next *higher*, subtract the lower number from the sum so borrowed, and to this difference add the upper number, and set the amount underneath, and *remember, always to carry one* to the next higher denomination, for what you have borrowed.

EXAMPLES.

	(1)				(2)		
	£	s.	d.		£	s.	d.
From	375	13	6½	From	417	15	7½
Take	187	15	9½	Take	256	16	8½
	(3)				(4)		
	£	s.	d.		£	s.	d.
From	1253	10	8	From	2910	12	4½
Take	915	13	9½	Take	973	14	3½

5. An English lady purchased goods, to the amount of £29 13s. 9d., and gave the shopman a fifty pound note to take his pay from; how much change did he hand her back ?

Ans. £20 6s. 3d.

6. A banker had a bag of gold, containing £509 14s. 6½d., out of which, at one time, he took £103 15s. 8½d., and at another, £147 17s. 9½d.; how much remained in the bag ?

Ans. £258 1s. 0½d.

7. A merchant bought a brig for £1234 19s. 6d., and put a cargo in her, worth £4375 14s. 9d., and after getting an insurance effected upon her, of £3490 17s. 8d., sent her to sea; a storm coming on, the ship and cargo were lost; what actual loss did the merchant sustain, after being paid the amount of insurance ?

Ans. £2119 16s. 7d.

TROY WEIGHT.

	(1)					(2)			
	lb.	oz.	pwt.	gr.		lb.	oz.	pwt.	gr.
From	416	8	13	17	From	391	10	16	
Take	149	9	16	21	Take	193	11	17	

COMPOUND SUBTRACTION.

(3)				(4)			
*lb. oz. pwt.				lb. oz. pwt. gr.			
From	1234	6	14	From	714	7	14 13
Take	496	8	17½	Take	375	9	16 14½

5. If from 1 lb. of silver, you take 13½ grs., how much is left?

6. A refiner had 4 wedges of gold, weighing, all together, 6 lb. 8 oz. 13 pwt. 14 gr.; one of them was stolen; on weighing those that were left, he found their weight to be 4 lb. 10 oz. 16 pwt. 20½ gr.; what was the weight of the one stolen?

Ans. 1 lb. 9 oz. 16 pwt. 17½ gr.

7. A gentleman carried 8 ingots of silver to a silver smith, the whole weight of which was 46 oz. 13 pwt. 17 gr.; out of it he made a tea-pot, wt. 8 oz. 12 pwt. 14 gr.; a sugar bowl and cream pot, wt. 7 oz. 14 pwt. 19 gr.; one pair of salts, wt. 3 oz. 13 pwt. 16 gr.; one dozen of table spoons, wt. 12 oz. 14 pwt. 18 gr.; and one dozen tea spoons, wt. 6 oz. 11 pwt. 10 gr.; what was the weight of all the articles made, and how much silver was left unwrought?

Ans. { Whole wt. 39 oz. 7 pwt. 5 gr.
Silver left, 7 oz. 6 pwt. 12 gr.

AVOIRDUPOIS WEIGHT.

(1)						(2)					
T. cwt. qr. lb. oz. dr.						T. cwt. qr. lb. oz. dr.					
From	941	16	1	17	12 11	From	123	14	2	16	10 6
Take	374	18	2	19	13 12	Take	87	15	3	17	12 13

(3)			(4)			(5)		
T. cwt.			T. cwt.			T. cwt.		
From	124	17	From	36	15½	From	1236	14
Take	46	18½	Take	12	17	Take	946	15½

6. A grocer bought 4 boxes of sugar, each weighing 4 cwt. 2 qrs. 14½ lbs.; after filling 4 bbls. each of which held 1 cwt. 3 qrs. 19½ lbs. and selling to a customer 8 cwt. 2 qrs. 18 lbs., how much had he remaining? *Ans.* 2 cwt. 0 qr. 18 lb.

7. Received by the brig Hector, 50½ tons of Russia iron: sold to A. 5 tons, 14½ cwt.; to B. 7 tons, 15½ cwt.; to C. 12 tons, 12½ cwt.; and D. wishes to buy the rest; how much remains for him?

Ans. 24 tons, 7½ cwt.

8. A farmer sent 3 loads of hay to market: the first, together with the wagon, weighed 24 cwt. 2 qrs. 21 lbs., the second, 19 cwt. 1 qr. 18 lbs., the third, 25 cwt. 3 qrs. 14 lbs., each

COMPOUND SUBTRACTION.

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of the wagons weighed 5 cwt. 1 qr. 13 lbs.; how much was there of the hay only? *Ans.* 53 cwt. 3 qrs. 14 lbs.

9. If you buy a box of butter, weighing, box and all, 36 lbs. 13½ ounces, and after taking out the butter, find the box to weigh 7 lbs. 14½ oz. how much will there be of the butter?

Ans. 28 lbs. 14½ oz.

APOTHECARIES WEIGHT.

(1)						(2)					
	lb.	oz.	dr.	sc.	gr.		lb.	oz.	dr.	sc.	gr.
From	13	8	7	1	14	From	146	6	5	2	13
Take	6	9	7	2	16	Take	25	3	5	2	15

(3)						(4)					
	lb.	oz.	dr.	sc.	gr.		lb.	oz.	dr.	sc.	gr.
From	137	5	3	0	16½	From	64	3	6	1½	
Take	49	8	6	1	18½	Take	37	4	7	2½	

5. Add together 49 lb. 2 oz. 4 dr. 1 sc. 13½ gr., and 37 lb. 5 oz. 3 dr. 1 sc. 6½ gr., and from their sum, subtract 7 dr. 2 sc. 19½ gr., and see how much remains.

Ans. 86 lb. 7 oz. 0 dr. 0 sc. 0½ gr.

CLOTH MEASURE.

(1)				(2)				(3)			
yds. qr. na.				E. E. qr. na.				yds.			
From	341	1	3	From	123	3	1	From	147	4	1
Take	187	2	3	Take	47	4	3	Take	96	1	1

(4)				(5)				(6)			
E. Fl. qr. na.				E. Fr. qr. na.				E. E.			
From	126	1	2	From	467	4	2	From	317½		
Take	49	2	3	Take	187	5	3	Take	189½		

7. From 3 pieces of cloth, each containing 46 yds. 3 qrs. 2 na., take 2 pieces, each containing 39 yds. 3 qrs. 3 na.; how much remains? *Ans.* 60 yds. 3 qrs.

8. A tailor had a piece of cloth, containing 36 yds. 2 from which he made two suits of clothes, each contain yds. 2½ qrs., and two surtouts, each 3 yds. 2½ qrs.; how of the cloth was left? *Ans.* 2

MISCELLANEOUS QUESTIONS.

1. A grocer bought a cask of wine, containing 136 gals. 2 qts. 1 pt., out of which, he filled 3 quarter casks, each holding 31 gals. 2 qts. 1 pt.; how much of the wine was left?

Ans. 41 gals. 3 qts.

2. A merchant sold 10 bags of coffee for \$175.50, by which he made \$38.75; can you tell how much the coffee cost him?

Ans. \$136.75.

3. A gentleman bought a tract of land, containing 1347 acres, 2 roods, and 25 rods; having sold to A. 143 acres, 1 rood, and 19 rods; to B. 75 acres, 3 roods, and 29 rods; he wishes to keep 450 acres, 2 roods, and 20 rods, for himself; how many acres can he still sell?

Ans. 677 acres, 2 roods, 37 rods.

4. Two ships sail from the same port, due West; after the lapse of 15 days, one is spoken $24^{\circ} 49' 34''$ West longitude, the other $31^{\circ} 47' 25''$ West longitude; how many degrees, minutes, and seconds, are they apart?

5. A man gave me a note, dated August 21st, 1826, but did not pay it till March 13th, 1829; how much time elapsed between the date of the note and the time of settlement?

Ans. 2 yrs. 6 mo. 22 days.

6. How long is it from June 10th, 1823, to September 14th, 1830?

Ans. 7 yrs. 3 mo. 4 days.

7. From 117 yrs. 8 mo. 19 d. 13 h. 27 m., take 95 yrs. 10 mo. 15 d. 30 m., and see how much remains.

8. A farmer sold a yoke of oxen for \$68.50, by which he lost \$13.75; can you tell how much his oxen cost him?

9. On the 11th of October, 1492, Christopher Columbus discovered the island of St. Salvador; how many years, months, and days, from that time to January 1st, 1831?

Ans. 338 yrs. 2 mo. 20 days.

10. A large reservoir is found to contain 4763487 gals. of water; now if three powerful engines are set to work, one discharging 25000 gals. 2 qts. and 1 pt. in an hour, the second discharging 17967 gals. 3 qts. 1 pt. in an hour, and the third discharging 28,763 gals. 3 qts. and 1 pt. in an hour, and each continue to play 3 hours, how many gallons will they all discharge, and how much water will be left in the reservoir?

Ans. { All will discharge 215197 gals. 0 qts. 1 pt.
 { There will remain 4548289 gals. 3 qts. 1 pt.

11. A merchant sold 20 bushels of salt for \$17, by which he lost \$3.00; what did the salt cost a bushel?

Ans. { Bought of a manufacturer, 3 bales of cotton
 { ing 24 pieces, and each piece $36\frac{1}{2}$ yards.
 yds. 2 qrs. 1 na., to B. 549 yds. 3 qrs.

12. to C. 384 yds. 3 qrs. 2 na., and keeping one piece for
 self, how much has he remaining, to sell?

Ans. 1181 yds. 0 qr. 2 na.

13. A merchant received an invoice of broadcloths and silks
 in England, amounting, together, to £1273 13s. 8½d.; the
 cloths alone cost £584 14s. 9½d.; what was the cost of the
 silks?

Ans. £688 18s. 10½d.

14. A farmer harvested three fields of corn; the first yielded
 325 bu. 3 pks. 6 qts., the second, 436 bu. 2 pks. 4 qts.,
 and the third, 587 bu. 3 pks. 7 qts. He paid to his landlord,
 7 bu. 2 pks. and 4 qts. for the rent of his farm; he gave to
 fattening cattle, 56 bu. 2 pks. 3 qts., to his fattening hogs, 35
 bu. 3 pks. 2 qts., and kept for his own use, 298 bushels; a mer-
 chant wished to purchase the rest; how much could the farmer
 sell him?

Ans. 592½ bushels.

COMPOUND MULTIPLICATION.

Q. What is Compound Multiplication?

A. It is when the multiplicand consists of several denomi-
 nations, as dollars, cents, and mills; or pounds, ounces, and
 grains, &c.

FEDERAL MONEY.

Q. In Multiplication of Federal Money, is it necessary that
 the dollars and cents should always be made the Multiplicand?

A. It is not; they may be used either for the multiplier or
 multiplicand, as is most convenient.

Q. What is the RULE?

A. Multiply exactly as in simple multiplication, and point
 off as many figures from the right hand of the product, as are
 pointed off in the given sum, whether it be used for the multi-
 plier or for the multiplicand.

Q. How do you proceed when both terms consist of dollars
 and cents?

A. Multiply as before, and point off as many figures from
 the right hand of the product, as are pointed off in both
 factors, counted together: then, all the figures at the left
 of the cut off, will be dollars, and the three first, at the
 right, will be cents and mills, and all beyond, on the right,
 decimals of a mill.

COMPOUND MULTIPLICATION.

EXAMPLES.

(1)		(2)		(3)	
	\$ cts.		\$ cts. m.		\$ cts. m.
Multiply	126,23	Multiply	346,367	Multiply	471,867
By	32	By	403	By	46
(4)		(5)		(6)	
Multiply	417,876	Multiply	673,06	Multiply	913,007
By	\$3,46	By	\$4,46	By	\$9,25

7. What will 24 yards of broadcloth amount to, at \$4,25 per yard?
Ans. \$102,00 cts.

8. Sold 17 gallons wine, at 1 dollar and nine cents the gallon; how much did it amount to?
Ans. \$18,53 cts.

9. Bought 36 lbs. of tea, at \$2,14 per pound; what did I pay?
Ans. \$77,04 cts.

10. Sold 36 yards of cambric, at \$2,20 the yard; what was the amount?
Ans. \$79,20 cts.

11. What must I pay for 2 bags of coffee, each weighing 127 lbs., at 16½ cts. a pound?
Ans. \$41,91 cts.

12. Bought 2 dozen pair of shoes, at \$1,37½ the pair; what do they come to?
Ans. \$33,00 cts.

13. What cost one chest of tea, weighing 64 lbs. (18 lbs. to be deducted out for the weight of the chest) at 87½ cts. the lb.
Ans. \$40,25 cts.

14. A merchant bought 4 bags of coffee, weighing, No. 1, 103 lbs.; No. 2, 114; No. 3, 110; and No. 4, 116 lbs.; what will they amount to at 14½ cts. a pound?
Ans. \$64,23½.

15. A butcher bought 25 sheep at \$2,37½ per head, and 15 lambs at \$1,87½ per head; what was the cost of the whole?
Ans. \$87,50.

16. A merchant sold 4 bales of goods; each bale contained 14 pieces, and each piece, 36½ yards; the price was 12½ cts. a yard; what was the amount of his bill?
Ans. \$255,50.

17. A grocer bought 10 kegs of butter, weight as follows, viz. 73 lbs. 64, 59, 62, 71, 68, 49, 58, 74, and 62 lbs.; tare, 13 pounds on each keg, to be deducted; how many pounds of butter, and to how much will it amount at 18½ cts. a pound?
Ans. Weight 510 lbs. Amount \$94,35 cts.

18. Sold 137 boxes of raisins at \$3,62½ a box; received 150 bushels of salt at 87½ cts. a bushel, in part pay, and the balance cash; how much money did I receive?
Ans. \$365,37½ cts.

An auctioneer sold 1500 bushels of salt at auction; as follows: to A. 250 bushels at 62½ cts., to B. 175 bushels at

64½ cts., to C. 350 bushels at 63½ cts., to D. 400 bushels at 64½ cts., to E. the remainder at 61½ cts.; how much salt was left for E., and what was the whole amount of sales?

Ans. { The quantity for E. you must find.
Amount of sales \$948,00 cts.

20. What must I give for 487 acres of new land at 5½ dollars an acre?

Ans. \$2739,37½ cts.

21. What will be the interest of 475 dollars, for 8 months, if every dollar gain ½ a cent a month?

22. A grocer bartered with a country merchant for the following produce: 450 lbs. of cheese at 6¼ cts. a lb.; 6 bushels of beans at \$1,25 a bushel; 136 lbs. of butter at 16½ cts. a lb.; 13 bushels of oats at 37½ cts. a bushel; 1 hog, wt. 364 lbs. at 8¼ cts. a lb.; for which he paid as follows: one half chest of souchong tea, wt. 31½ lbs. at 45 cts. per lb.; 1 bag of coffee, wt. 87 lbs. at 14½ cts. per lb.; 1 bbl. of new rum, 34 gals. at 32 cts. per gallon, besides 1 dollar for the barrel; 1 quarter cask of Malaga wine, 31½ gals. at 85 cts. per gal.; the balance, either way, was to be paid in cash; what was the balance, and to whom was it due? *Ans.* Due to the merchant, \$27,52½.

23. A merchant bought 5 pipes of wine, gauge and outs as follows: 127—7 out, 136—5 out, 114—8 out, 121—5 out, 118—6 out, at 87½ cts. a gal.; how many gallons of wine were there, and what was their cost?

Ans. 585 gallons; and they cost 511,87½ cts.

24. What will be the interest of 340 dollars, if every dollar gain ½ a cent a month for 6 months?

25. What will be the interest of 50 dollars for 3 months, at the same rate?

26. What is the interest of 175 dollars for 9 months, at the same rate?

27. A grocer bought 10 chests of tea, weight as follows: 56½, 49½, 57½, 55½, 53, 62½, 63½, 62, 49½, and 47½ pounds, deducting 18 pounds tare for the weight of each chest; what was the whole weight of tea, and to what did it amount, at 62½ cts. a pound? *Ans.* Whole weight 377 lb. Amount \$235,62½.

28. What must be given for 17 cwt. of sugar at 12½ cts. a pound?

Ans. \$238,00 cts.

29. A lady bought in a dry goods' store, 6½ yds. of silk at 75 cts. a yard, 7 yds. of linen cambric at 1,37½ cts., 15 yds. of domestic shirting at 12½ cts., 6 pair of cotton hose at 62½ cts. per pair, 9 yds. of chintz at 37½ cts. a yard; what was the amount of her bill?

Ans. \$23,50 cts.

30. A hatter sold 3 boxes of hats, each box containing dozen, at \$3,62½ apiece; what was the amount.

Ans. \$328,2½

31. What must a manufacturer pay for the calendering of 46 pieces of cloth, each containing $36\frac{1}{2}$ yds. at $1\frac{1}{2}$ cts. per yard?

Ans. \$29,38 $\frac{1}{2}$ cts.

32. A merchant sold 4 hhds. of molasses, gauge and outs as follows, viz: 118—6 out; 113—4; 108—7, and 114—5 out, at $37\frac{1}{2}$ cts. per gallon, and took his pay in part, by 8 bags of coffee, weight as follows: 104, 93, 87, 102, 106, 97, 105, and 113 pounds, at $15\frac{1}{2}$ cts. per pound; to what did the coffee and molasses each amount, and what was the balance due for the molasses?

<i>Ans.</i> {	Molasses amounted to	\$161,62 $\frac{1}{2}$ cts.
	Coffee	125,08 $\frac{1}{2}$ cts.
	Balance due	36,54 cts.

33. A wealthy farmer sold off the following products of his farm, viz: 125 bushels of corn at $87\frac{1}{2}$ cts. a bushel; 250 bushels of rye at 92 cents; 500 bushels of potatoes at 28 cents; 100 bbls. cider at \$1,37 $\frac{1}{2}$ a barrel; 5750 lbs. of cheese at $7\frac{1}{2}$ cents a pound; 450 lbs. of butter at $16\frac{1}{2}$ cents; 25 fat sheep at 3 dollars 12 $\frac{1}{2}$ cents a head; 4 fat oxen, weighing 875 lbs. each, at $4\frac{1}{2}$ cents a pound; 12 fat hogs, weighing in all, 3650 lbs. at $6\frac{1}{2}$ cents a pound, and poultry, to the amount of \$25: what was the amount of his whole produce, and what was his neat income, after deducting \$350 for rent of farm, \$225 for hired help, and \$350 for the expenses of his family?

<i>Ans.</i> {	Amount of produce	\$1602,37 $\frac{1}{2}$ cts.
	His neat income was	\$677,37 $\frac{1}{2}$ cts.

CASE SECOND.

Q. How do you find the value of articles, that are sold by the hundred or thousand, as boards, clapboards, shingles, hoops, bricks, &c.

A. Multiply the number by the price, or the price by the number, as is most convenient; then if the article be sold by the 100, cut off the two right hand figures; if by the 1000, cut off three right hand figures, and those on the left will be the answer, in the same denomination as the given price.

Q. If the price be dollars, what will those figures on the right hand be?

A. Cents, or cents and mills.

EXAMPLES.

1. What cost 25460 feet of boards at $9\frac{1}{2}$ dollars the thousand?

Ans. \$241,87 cts.

Hoops at 18 dollars the thousand?

Ans. \$261.

3. What must I give for 18000 shingles at \$4,25 the thousand ?

Ans. \$76,50 cts.

4. What cost 45376 bricks at \$5½ the thousand ?

Ans. \$249,56 cts.

5. A merchant shipped to the West Indies, 15000 staves at \$9 the thousand, 35000 hoops at \$18,50, 18450 feet of boards at \$20, and 2460 lbs. of hams at \$10 the hundred ; he received in return, 1500 gallons of molasses worth \$25 the hundred ; 500 gallons of rum worth \$60 the hundred, 15000 lbs. of coffee worth \$12½ the hundred, his shipping expenses amounted to \$350 ; did he gain or lose, and how much ?

Ans. Gained \$802,50 cts.

6. A merchant bought from a lumber vessel, 17635 feet of boards at \$2½ the hundred, 9647 feet at \$1½ the hundred, 70000 shingles at \$3,25 the thousand, and 45000 clapboards at \$5,25 the thousand. What was the whole amount ?

Ans. \$1049,33 cts.

STERLING MONEY, WEIGHTS, AND MEASURES.

Q. What is the RULE for multiplication of Sterling Money, weights, and measures ?

A. Write down the multiplicand, and place the quantity under the least denomination for a multiplier ; then multiply each denomination by the multiplier, separately, dividing each product by as many of that denomination as make *one* of the next greater ; set down the remainder under the denomination multiplied, and carry the quotient to the product of the next higher denomination, and thus proceed till you come to the last, which multiply as in simple multiplication.

Q. What if there are still *higher* denominations, belonging to the weight or measure, than the last term multiplied ?

A. Divide (if necessary) this last product as before, setting the remainder underneath, and place the quotient out at the left hand, for so many of the next higher denomination,

EXAMPLES.

		(1)		
	£	s.	d.	
Multiply	131	12	6½	
By			2	

		(2)
	lbs.	oz. pw
Multiply	146	8 1
By		

$$\begin{array}{r} \text{lb. oz. dr.} \\ \text{Multiply } 137 \ 12 \ 11 \\ \text{By} \qquad \qquad \qquad 3 \\ \hline \end{array}$$

$$\begin{array}{r} \text{lb. oz. dr. sc. gr.} \\ \text{Multiply } 127 \ 8 \ 6 \ 2 \ 14 \\ \text{By} \qquad \qquad \qquad 3 \\ \hline \end{array}$$

$$\begin{array}{r} \text{T. cwt. qr. lb.} \\ \text{Multiply } 14 \ 13 \ 2 \ 14 \\ \text{By} \qquad \qquad \qquad 4 \\ \hline \end{array}$$

$$\begin{array}{r} \text{cwt. qr. lbs. oz. dr.} \\ \text{Multiply } 13 \ 1 \ 21 \ 12 \ 13 \\ \text{By} \qquad \qquad \qquad 4 \\ \hline \end{array}$$

$$\begin{array}{r} \text{pipes hhds. gals. qts. pt.} \\ \text{Multiply } 13 \ 1 \ 25 \ 3 \ 1 \\ \text{By} \qquad \qquad \qquad 5 \\ \hline \end{array}$$

$$\begin{array}{r} \text{yds. qr. na.} \\ \text{Multiply } 160 \ 3 \ 3 \\ \text{By} \qquad \qquad \qquad 5 \\ \hline \end{array}$$

N. B. The scholar, in order to find the correctness of his answer, must multiply it by 2, and if the product agree with the answer in the book, his sum is right.

9. What cost nine yards of English cloth at £1 13s. 6½d. per yard? *Ans.* ×2=£30 3s. 9d.

10. What is the weight of 7 ingots of silver, each weighing 2 lbs. 8 oz. 14 pwt. 16 grs. ?

Ans. ×2=£38 lbs. 2 oz. 5 pwt. 8 grs.

11. A man travelled 34 m. 5 fur. 24 rods in a day; how far did he travel in 9 days? *Ans.* ×2=624 m. 4. fur. 32 rds.

12. What is the weight of 9 silver spoons, each weighing 1 oz. 13 pwt. and 16 grs. ? *Ans.* ×2=2 lbs. 6 oz. 6 pwt.

13. If a man earn 4s. 6d. a day, how much must you pay for 6 days' labor? *Ans.* ×2=£2 14s.

14. How much wood in 5 piles, each measuring 11 cords, 6 ft. and 8 inches? *Ans.* ×2=118 cords, 2 ft. 8 inches?

15. A merchant bought 6 pipes of wine, each containing 126 gallons; out of which he filled 12 quarter casks, each containing 34 gallons, 2 qts. and 1½ pints; how much of the wine was left? *Ans.* ×2=679 gals. 2 qts.

16. What is the weight of 8 boxes of Havana sugar, each weighing 3 cwt. 2 qrs. 21 lbs. ? *Ans.* ×2=59 cwt.

17. What weight in 6 boxes of medicine, each weighing 14 lbs. 8 oz. 6 dr. 2 sc. 14 gr.

18. Bought 4 pieces cloth, each piece containing 21 yds. 2 na.; how many yards did I purchase?

Ans. ×2=175 yds.

the weight of 4 loads of hay, each weighing qrs. 14 lbs. ?

20. How much wine in six casks, each containing 31 gals. 2 qts. 1 pt. 3 gills? *Ans.* $\times 2 = 380$ gals. 2 qts. 1 pt.

21. A grocer had 4 hhds. of sugar, weight of each 9 cwt. 2 qrs. 14 lbs., out of which he filled 9 bbls. each containing 2 cwt. 3 qrs. 12 lbs.; how much sugar remained? *Ans.* $\times 2 = 25$ cwt. 2 qrs. 5 lbs.

22. If a boy study 7 hours, 25 min. 13 sec. in one day, how much will he study in 5 days? *Ans.* $\times 2 = 74$ hrs. 12 min. 10 sec.

23. A ship sailed in one day, $3^{\circ} 40' 35''$; how far will she sail in 11 days? *Ans.* $\times 2 = 50^{\circ} 52' 59''$.

24. A druggist made a compound, consisting of 5 ingredients, each weighing 4 lbs. 0 oz. 0 dr. 1 sc. 13 grs. What was the weight of the whole mixture? *Ans.* $\times 2 = 40$ lbs. 0 oz. 5 dr. 1 sc. 10 grs.

25. If I spend £4 13s. 9d. in a day, what do I spend in a week? *Ans.* $\times 2 = \text{£}65$ 12s. 6d.

CASE SECOND.

Q. What is the second case in Compound Multiplication?

A. When the multiplier is a composite number, and more than 12.

Q. What is a composite number?

A. It is the product of two numbers, in the table, multiplied together, as $4 \times 6 = 24$. Therefore 24 is a composite number, of which 4 and 6, are the component parts.

Q. What is the Rule in this case?

A. Take any two numbers, whose product (when they are multiplied together) will exactly make the given multiplier, and multiply, first by one of those figures, and *that* product by the *other* figure, and the *last* product will be the answer or term sought.

EXAMPLES.

1. What will be the product of £16 13s. 8½d. multiplied by 24?

Operation, $4 \times 6 = 24$, the multiplier.

Therefore multiply $\begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 16 \quad 13 \quad 8\frac{1}{2} \end{array}$ the given multiplicand,
by $\begin{array}{r} 4 \\ \hline \end{array}$

and it produces $\begin{array}{r} 66 \quad 14 \quad 10 \end{array}$ the product of the *one*
Then multiply this product by 6 the other component

and it produces $\begin{array}{r} 400 \quad 9 \quad 0 \end{array}$ the product of the

COMPOUND MULTIPLICATION.

- | | | | |
|-------------|--------------------|------|--------------------|
| | T. cwt. qr. lb. | | T. cwt. qr. lb. |
| 2. Multiply | 4 16 1 16 by 36. | Ans. | 173 10 0 16 |
| | lb. oz. pwt. gr. | | lb. oz. pwt. gr. |
| 3. Multiply | 16 8 13 14 by 42. | Ans. | 702 4 10 12 |
| | yds. qrs. na. | | yds. qrs. na. |
| 4. Multiply | 131 3 3 by 56 | Ans. | 7388 2 0 |
| | acres rds. rods. | | acres rds. rods. |
| 5. Multiply | 13 3 23 by 49. | Ans. | 680 3 7 |
| | gals. qts. pt. gi. | | gals. qts. pt. gi. |
| 6. Multiply | 27 3 1 2 by 63. | Ans. | 1760 0 0 2 |
| | lb. oz. dr. | | lb. oz. dr. |
| 7. Multiply | 141 11 12 by 64. | Ans. | 9071 0 0 |
| | deg. min. sec. | | deg. min. sec. |
| 8. Multiply | 79 29 43 by 72. | Ans. | 5723 39 36 |

CASE THIRD.

Q. When the multiplier is larger than 12, and not a *composite* number, what is the RULE?

A. Take any two such numbers in the table, whose product will come nearest to the given multiplier, and multiply by them as before; then multiply the given multiplicand by what remains, and add this *last* product to the previous one, and their *sum* will be the product or answer.

EXAMPLES.

What is the product of £24 13s. 8½d. multiplied by 26?

Operation, $4 \times 6 = 24$ + 2 = 26 the multiplier.

Therefore multiply 24 13 8½ the given multiplicand,
by 4 the first component figure of 24,

and it produces 98 14 9 the product or price of 4; now multiply this product by 6 the other component of 24,

and it produces 592 8 6 the product or price of 24, and 24 13 8½ × 2 produces 49 7 4½ the product or price of 2, which being added to the former product,
produces 641 15 10½ the product or price of 26.

	£ s. d.		£ s. d.
7. Multiply	13 8 6½ by 38.	Ans.	510 4 7

- | | | | |
|-------------|-------------------------|------|------------------------|
| | T. cwt. qr. lb. | | T. cwt. qr. lb. |
| 3. Multiply | 14 13 1 14 by 17. | Ans. | 249 7 1 14 |
| | cwt. qr. lb. oz. | | cwt. qr. lb. oz. |
| 4. Multiply | 14 2 13 12 by 23. | Ans. | 336 1 8 4 |
| | yds. qr. na. | | yds. qr. na. |
| 5. Multiply | 13 2 3 by 29. | Ans. | 396 3 3 |
| | S. ° ' " | | S. ° ' " |
| 6. Multiply | 13 15 39 25 by 34. | Ans. | 459 22 21 52 |
| | acres rds. rods. | | acres rds. rods. |
| 7. Multiply | 14 2 25 by 43. | Ans. | 630 0 35 |
| | lb. oz. pwt. gr. | | lb. oz. pwt. gr. |
| 8. Multiply | 131 10 14 18 by 38 | Ans. | 5012 0 0 12 |
| | hhds. gals. qt. pt. gi. | | hhds. gal. qt. pt. gi. |
| 9. Multiply | 13 29 3 1 2 by 19. | Ans. | 256 1 3 0 2 |

MISCELLANEOUS QUESTIONS.

- What is the weight of 16 barrels of sugar, each weighing 2 cwt. 1 qr. 13 lbs. ?
Ans. 37 cwt. 3 qrs. 12 lb.
- How many yards of cloth in 36 pieces, each piece containing 26 yds. 2 qrs. 3 na. ?
Ans. 960 yds. 3 qrs.
- How much hay on 17 acres of meadow, if each acre yield 3 T. 14 cwt. 3 qrs. 18 lbs. ?
Ans. 63 T. 13 cwt. 1 qr. 26 lbs.
- How much wine in 27 casks, each containing 32 gals. 2 qts. 1 pt. ?
Ans. 880 gals. 3 qts. 1 pt.
- A silversmith sold 2 dozen of table spoons, each weighing 2 oz. 12 pwt. 17 grs.; 2½ dozen tea spoons, weight of each, 14 pwt. 16 grs.; and one dozen fruit knives, weight of each, 2 oz. 13 pwt. 10 grs.; what did the whole weigh ?
Ans. 9 lbs. 9. oz. 6 pwt.
- If a ship sail 2° 13' 14" in one day, how far will she sail during the month of February, 1831 ?
Ans. 62° 10' 33".
- A grocer purchased 14 hhds. sugar, weight, each, 8 cwt. 1 qr. 14 lbs.; 26 boxes, weight, each, 4 cwt. 2 qr. 18 lbs.; and 38 barrels, weight, each, 2 cwt. 0 qr. 20 lbs; what was the whole weight ?
Ans. 321 cwt. 0 qr. 24 lbs.
- What will 27 yards of silk come to at 6s. 9½d. a yard ?
Ans. £9 3s. 4½d.
- If the month of July come in, on Sunday, and a laborer let himself to work, every working day, at 7s. 6d. a day, to what will his month's wages amount ?
Ans. £9 15s.
- A farmer harvested 47 acres of wheat, which yielded 35 bu. 2 pks. and 6 qts. to the acre; 14 acres of rye, yielding

27 bu. 3 pks. 5 qts. to the acre ; and 9 acres of corn, yielding 45 bu. 3 pks. 6 qts. to the acre ; how many bushels of each, and how many in all ?

Ans. $\left\{ \begin{array}{l} 1677 \text{ bus. } 1 \text{ pk. } 2 \text{ qts. of wheat.} \\ 390 \text{ " } 2 \text{ " } 6 \text{ " of rye.} \\ 413 \text{ " } 1 \text{ " } 6 \text{ " of corn.} \\ 2481 \text{ " } 1 \text{ " } 6 \text{ " of the whole.} \end{array} \right.$

11. If I buy 21 boxes of sugar, weight of each, 3 cwt. 2 qrs. 19 lbs., and sell 28 bbls. weight each, 2 cwt. 3 qrs. 24 lbs., do I buy or sell most, and how much ?

Ans. I sell 5 cwt. 3 qrs. 21 lbs. more than I buy.

COMPOUND DIVISION.

Q. What is Compound Division ?

A. It is when the dividend consists of several denominations, as dollars, cents, mills ; pounds, ounces, drams ; days, hours, &c.

FEDERAL MONEY.

Q. What is the RULE for Division of Federal Money ?

A. Write down the dividend in *cents*, and divide the same as in simple division, and the quotient will be cents : or, as is sometimes necessary, write it down in *mills*, and the quotient will be mills, which must be brought to dollars.

Q. If the divisor and dividend both consist of dollars and cents, how do you proceed ?

A. Write them both down in the lowest denomination mentioned in either : that is, if there be cents in *either* term, write *both* the terms in cents ; or if there be mills in either, write both in mills ; then divide as before, and the quotient will be dollars.

Q. What is to be done with a remainder, if there should be any ?

A. Annex two ciphers, or multiply it by 100, to bring it to cents ; divide again, and this quotient will be cents ; and if great exactness be necessary, annex another cipher to the remainder, if any, and the quotient will be mills.

Q. If cents be divided by cents, or mills be divided by mills, what will the quotient be ?

A. It will be dollars.

What then will any whole number or any fraction divided, produce ?

COMPOUND DIVISION.

95

A. A unit or whole number, of whatever kind the term which is divided may be, whether of money, weight, or measure.

EXAMPLES.

1. Divisor 24) $\begin{matrix} \$ & \text{cts.} & \text{c. m.} \\ 386,87(16,119 \end{matrix}$ Quotient or answer.

$$\begin{array}{r} 24 \\ \hline 146 \\ 144 \\ \hline 28 \\ 24 \\ \hline 47 \\ 24 \\ \hline \end{array}$$

Annex a cipher $\begin{matrix} 230 \\ 216 \end{matrix}$

14 Remainder.

2. Divide 134 dollars by \$4,62½. I here write down the divisor and dividend in mills.

$\begin{matrix} \text{mills.} & \text{mills.} & \text{c. m.} \\ \text{Thus } 4625)134000(\$28,972 \end{matrix}$ Answer.

9250

$$\begin{array}{r} 41500 \\ 37000 \\ \hline \end{array}$$

Annex two ciphers. $\begin{matrix} 450000 \\ 41625 \end{matrix}$

$$\begin{array}{r} 33750 \\ 32375 \\ \hline \end{array}$$

Annex a cipher. $\begin{matrix} 13750 \\ 9250 \end{matrix}$

4500 Remainder.

3. If 146 dollars be divided equally among 12 men, how much will each man have? *Ans.* \$12,16 cts. 6 mills.

4. If 18 bbls. of flour cost \$189, what is that a barrel?

5. A company of 6 men made \$5000; how much was each man's share? *Ans.* \$833,33 cts. 3 mil

6. If a piece of cloth, containing 24 yds. cost \$9, what cost one yard?

7. If an estate of 25687 dollars be divided among 8 children, what will be each child's share? *Ans.* \$3210,87½.

8. Bought a piece of cloth, containing 36 yds. for 18 dollars; what did it cost a yard?

9. A gentleman bought a farm, containing 125 acres, for 2795 dollars, and wished by selling it, to make 525 dollars by his bargain; what must he ask per acre, in order to do this? *Ans.* \$26,56 cts.

10. Bought a piece of cloth, containing 38 yds. for 19 dollars, and I wish to make, in the sale of it, \$4,75; how much must I sell it per yard? *Ans.* \$0,62½.

11. Four boys found a purse, containing 15 dollars and 50 cents; what was each boy's share of the money? *Ans.* \$3,87½.

12. A merchant bought 4 pieces of Canton crape at \$11,50 cts. the piece; what must he sell it for per piece, to gain 9 dollars on the whole? *Ans.* \$13,75.

13. A merchant sold 126 gallons of wine, by which he lost \$46,75; what was his loss on each gallon? *Ans.* 37 cts. 1 m.

14. I purchased two lots of land, one containing 125 acres, for 5000 dollars; the other containing 36 acres, for 360 dollars; I wish to sell both lots together, and make 500 dollars by the bargain; what must I get an acre for them? *Ans.* \$36,39 cts. 7 m.

15. A merchant bought 9 pieces of cloth, each piece containing 26 yds. at 37½ cts. a yard; he wishes to keep one piece for himself, and sell the remaining 8 pieces, for enough to pay for the whole; how much must he ask for each yard? *Ans.* 42 cts. 1 mill.

16. A flour dealer sold 25 bbls. of flour for \$262,50, by which he lost \$18,75; what did it cost a barrel? *Ans.* 11,25.

17. A merchant bought a pipe of wine, containing 136 gallons at \$1,37½ a gallon; by accident, 13 gallons leaked away; how must he sell the residue per gallon, to gain \$13,12½ on the whole cost? *Ans.* \$1,62 cts. 7 mills.

18. A man dying, left an estate worth 12750 dollars, but there were demands against his property, to the amount of 3460 dollars, besides the expenses of settling the estate, which amounted to 750 dollars; the residue, after payment of these claims, was equally divided between his two sons and his three daughters; what was the portion of each? *Ans.* 1708 dollars.

19. A dealer in dry goods purchased 4 pieces of silk; each contained 24½ yds. at \$1,62½ per yard; he afterwards pieces for 80 dollars; how much must he retail the other

o pieces, per yard, in order to gain 2 dollars apiece, on the whole ?

Ans. \$1,78 cts.

20. A grocer bought 5 hhd. of molasses, containing as follows : 108, 106, 110, 112, and 117 galls. at $32\frac{1}{2}$ cts. a gallon, 6 of which, viz. 108 and 106, being of an inferior quality, sold for 30 cts. the gallon ; how must he sell the remainder : gallon, to make 5 dollars on every hhd. of the purchase ?

Ans. 41 cts. 4 mills.

21. A boy bought a bushel of apples, containing 425 in number, for one dollar ; how must he sell them apiece, to make 70 cts. by his bargain ?

22. A privateer, manned by a captain, mate, and 20 seamen, took a prize, the cargo of which was sold for 1760 dollars, 50 cts. The vessel brought 5750 dollars, 75 cents ; besides 25 thousand dollars in specie, which she had on board. The owners, three in number, claimed one half of the whole, one third the remainder was divided between the captain and mate, and the residue was shared by the 20 sailors equally ; what was each owner's, captain's, mate's, and sailor's share of the prize ?

Ans. { Each owner's, \$5418,54 cents.
 { Captain's and mate's, each \$2709,27 cts.
 { Each sailor's, \$541,85 cts. 4 mills.

23. I sold a chest of tea, weighing 62 lbs. for $62\frac{1}{2}$ cts. a pound, by which I lost \$7,75 ; how ought I to have sold it per pound, so as not to lose any thing ?

Ans. 75 cts.

24. Bought 4 pieces of domestic sheeting, each piece, containing 36 yds., for 18 dollars ; what did I give a yard ?

Ans. $12\frac{1}{2}$ cts.

25. A certain town is taxed \$3137,43 cts ; the whole property of the town is \$89640,76 ; there are 120 polls, taxed 2 cents each ; now tell, if you can, the tax on a dollar ?

Ans. 3 cts. $3\frac{9}{10}$ mills.

26. Bought a piece of broadcloth, containing 45 yards, for \$1,37 $\frac{1}{2}$ a yard, but not proving so good as I expected, I lost \$1,25 in the sale of it ; what did I get a yard ?

Ans. \$6,12 $\frac{1}{2}$.

27. If a town whose taxable property is \$153,647, pay a tax \$6145,88 cts. what is that on a dollar, and what must that man pay, whose estate is valued at 23475,67.

Ans. 4 cts. on a dollar ; and the man must pay \$939,027 mills.

CASE SECOND.

Q. When it is required to lay out any given sum of money, the purchase of any article at a given price per pound, &c. what is the RULE ?

I

A. Write down the amount, to be so laid out, in the lowest denomination, mentioned in the *price* of the article to be *purchased*, for a dividend, and divide it by the price, and the quotient will be the answer, or the quantity of goods which the given amount will buy.

EXAMPLES.

1. A merchant remitted to his agent in Georgia, 1750 dollars, to be laid out in the purchase of cotton, at 18 cents a pound; how many pounds of cotton did it purchase?

N. B. As the price to be paid is cents, write down the amount, to be expended, in cents, and pursue the following process.

Divisor 18 cts.) 175000 (9722 pounds. *Ans.*

$$\begin{array}{r}
 162 \\
 \hline
 130 \\
 126 \\
 \hline
 40 \\
 36 \\
 \hline
 40 \\
 36 \\
 \hline
 \end{array}$$

4 cts. Remainder.

2. A poor market-woman carried her berries and a few eggs to market, which she sold for \$1,12½, and laid out the money in sugar at 12½ cts. a pound; how many pounds did she buy?

3. A merchant sent to his agent in Baltimore, 3468 dollars, for the purchase of flour, for which the agent gave \$8,50 a barrel; how much flour did he buy? *Ans.* 408 bbls.

4. How much molasses can you buy for \$4,50, at 37½ cts. a gallon?

5. A friend left with me 130 dollars to buy cheese, at 6½ cents a pound; how much could I buy for the money?

Ans. 2000 lbs.

6. A boy was sent to the market with \$2,50, to buy as much butter as he could for the money; he found some for 12½ cents a pound; how many pounds did he buy?

7. How much molasses can you buy for \$8,50 at 37½ cents per gallon?

8. A merchant owes me 750 dollars, but not being able to pay me the money, I have agreed to take my pay in souchong at 62½ cents the pound; how many pounds of tea must he for the debt?

Ans. 1200 lbs.

9. A grocer sold a pipe of wine containing 118 gals. at $87\frac{1}{2}$ cents a gal., and took his pay in butter at 18 cts. per lb.; how much butter paid for the wine? *Ans.* 573 lbs. 11 cts. over.

10. A servant was sent with 2 dollars to buy beef, at $4\frac{1}{2}$ pence a pound; how many pounds could he buy? *Ans.* 32 lbs.

11. A merchant shipped to New-Orleans, 40 cases domestic goods, each case containing 36 pieces, and each piece, $35\frac{1}{2}$ yds. which sold there for $14\frac{1}{2}$ cents a yard; his agent laid out the amount of the sale in molasses, at 25 cents a gallon; how many gallons did he buy? *Ans.* 29649 galls. and 15 cents remain.

12. I sent to New-York, 75 kegs of lard, each weighing 45 pounds; it brought 9 cts. a pound, and the amount was laid out in flour at $\$5\frac{1}{2}$ a barrel; how many barrels must I receive? *Ans.* 55 bbls. and $\$1,25$ over.

13. If I sell 50 bbls. of pork at $14\frac{1}{2}$ dollars a barrel; and 75 bbls. of beef at $9\frac{1}{2}$ dollars a barrel, and take my pay in wine at $\$1,75$ a gallon; how much wine must I receive? *Ans.* 821 galls. and 75 cents over.

14. A farmer sold 1475 lbs. of cheese for $4\frac{1}{2}$ pence per lb. and laid out his money in salt at $\$1,12\frac{1}{2}$ a bushel; how much salt could he buy? *Ans.* 81 bu. 3 pks. 6 qts.

15. A merchant bought broadcloth to the amount of 187 $\frac{1}{2}$ dollars, at $\$3,75$ a yard; how many yards did he buy? *Ans.* 50 yds.

16. If you spend $\$1,25$ a day; how long will 1000 dollars last you? *Ans.* 800 days.

STERLING MONEY, WEIGHTS AND MEASURES.

Q. What is the RULE for Division of Sterling Money, Weights and Measures?

A. Begin with the highest denomination and divide it as in simple division, and if any thing remain, multiply this remainder by that number which it takes of the next lower denomination, to make one of that denomination which you are dividing; and remember to add this product to the next lower denomination (if there be any) for a new dividend; then divide again as before, and if any thing still remain, proceed with it in the same manner until you have divided as far as the question requires.

EXAMPLES.

1.				2.			
£	s.	d.	qrs.	lbs.	oz.	pwt.	grs.
Divisor 2)21	13	6	2	Divisor 3)136	8		

COMPOUND DIVISION.

$$\begin{array}{r} 3. \\ \text{yds. qrs. na.} \\ 4)376 \quad 2 \quad 3 \end{array}$$

$$\begin{array}{r} 4. \\ \text{T. cwt. qrs. lbs.} \\ 5)37 \quad 16 \quad 2 \quad 14 \end{array}$$

$$\begin{array}{r} 5. \\ \text{bush. pk. qt. pt. gi.} \\ 6)136 \quad 1 \quad 6 \quad 1 \quad 3 \end{array}$$

$$\begin{array}{r} 6. \\ \text{Y. d. h. m.} \\ 7)146 \quad 145 \quad 16 \quad 37 \end{array}$$

$$\begin{array}{r} 7. \\ \text{cwt. qrs. lbs. oz.} \\ 2)27 \quad 1 \quad 13 \quad 19 \end{array}$$

$$\begin{array}{r} 8. \\ \text{gals. qts. pts. gi.} \\ 3)191 \quad 3 \quad 1 \quad 2 \end{array}$$

$$\begin{array}{r} 9. \\ \text{mi. fur. rds.} \\ 4)321 \quad 6 \quad 36 \end{array}$$

$$\begin{array}{r} 10. \\ \text{acres rds. rods.} \\ 5)49 \quad 3 \quad 30 \end{array}$$

$$\begin{array}{r} 11. \\ \text{S. deg. min. sec.} \\ 6)8 \quad 20 \quad 40 \quad 24 \end{array}$$

$$\begin{array}{r} 12. \\ \text{cords ft. in.} \\ 7)17 \quad 114 \quad 121 \end{array}$$

13. A farmer had 7 tons of hay, which he wished to send to market by 6 teams; how much must each team carry?

Ans. 1 T. 3 cwt. 1 qr. $9\frac{3}{4}$ lbs.

14. Eight merchant tailors bought a bale of cloth, containing 155 yards, to be equally divided among them; how many yards fell to each share?

15. A vessel sailed 2 signs, 18 deg. 34 min. 40 sec. in 9 days; how far did she sail each day?

16. Six men bought a pile of wood, measuring 37 cords and 67 feet; how many cords had each man?

17. Five men bought, in company, 377 bushels of salt; what was each one's share?

18. A farmer had a lot of land, containing 25 acres, 3 roods, 8 rods, which he wanted to fence into 4 lots of equal size; how many acres did each contain?

19. Twelve men were concerned in building a manufacturing establishment in England, which cost £47549 10s. 6d.; what must each man pay?

20. Six men bought the hay, standing on 8 acres of meadow, which yielded 3 T. 9 cwt. 2 qrs. 17 lbs. to the acre; how much share? *Ans.* 4 T. 12 cwt. 3 qrs. $13\frac{1}{2}$ lbs.

CASE SECOND.

Q. When the divisor is a composite number and more than 12, what is the RULE?

A. Take two such figures, as, when multiplied together, will exactly produce the divisor; then divide, first by one of those figures, and that quotient by the other, and the last quotient will be the answer.

Q. If there be any remainder, after dividing by each of those figures, how can you find the true remainder?

A. Multiply the *last remainder* by the *first divisor*, and add in the *first remainder*, under which write the whole divisor.

EXAMPLES.

1. Divide £124 13s. 6½d. by 24.

Operation. $4 \times 6 = 24$ the divisor. Therefore divide the dividend first by 4)124 13 6½

$$\begin{array}{r} 6 \overline{)31 \ 3 \ 4\frac{1}{2}-2} \\ \hline \end{array}$$

$$\text{Ans. } 5 \ 3 \ 10\frac{1}{4}-\frac{2}{4}$$

2. Divide 46 T. 13 cwt. 2 qrs. 21 lbs. by 28.

Operation. $4 \times 7 = 28$ the divisor. Therefore divide the dividend first by 4)46 13 2 21 0

$$\begin{array}{r} 7 \overline{)11 \ 13 \ 1 \ 19 \ 4} \\ \hline \end{array}$$

$$\text{Ans. } 1 \ 13 \ 1 \ 10 \ 12$$

3. Divide 131 lbs. 8 oz. 14 pwt. 16 grs. by 32.

Ans. 4 lb. 1 oz. 7 pwt. 23 grs.

4. Divide 146 acres, 3 roods, 24 rods, by 36.

Ans. 4 acres, 0 roods, 12½ rods.

5. Divide 275 yards, 3 qrs. 3 nails, by 42.

Ans. 6 yards, 2 qrs. 1½ nails.

6. Divide 436 bushels, 3 pecks, 6 quarts, 1 pint, 2 gills, by 45.

Ans. 9 bu. 2 pks. 6 qts. 1 pt. 1¾ gi.

7. Divide 12 signs, 24 deg. 35 min. 46 sec. by 49.

Ans. 0 S. 7 deg. 50 min. 56⅔ sec.

8. Divide 123 hhds. 26 gals. 3 quarts, 1 pint, 3 gills, by 64.

Ans. 1 hhd. 58 gals. 1 qt. 1 pt. 3¾ gi.

9. Divide 17 tons, 18 cwt. 2 qrs. 24 lbs. 12 oz. 9 dr. by 144.

Ans. 0 T. 2 cwt. 1 qr. 27 lbs. 0 oz. 1⅓ dr.

10. Eighteen men purchased a cargo of Lehigh coal
ing 75 tons, 18 cwt. 3 qrs. 14 lbs.; how much was e
share?

Ans. 4 tons, 4 cwt. 1 qr.

CASE THIRD.

Q. When the divisor is large, and not a composite number, what is the **RULE**?

A. Divide by the whole divisor at once, after the manner of long division.

EXAMPLES.

1. Divide £147 14s. 9½d. by 26.

Operation. Divisor 26)147 14 9½(£5 the first quotient.

Multiply this remainder, 17 by 20 and add in the 14s. to bring it to shillings.

20

Divide this product by 26)354(13s. 2d quotient.

26

94

78

Multiply this remainder 16 by 12, and add in the 9d. to bring it to pence.

12

Divide this product by 26)201(7s. 3d quotient.

182

Multiply this remainder 19 by 4 and add in the 2 qrs. to bring it to qrs.

4

Divide this product by 26)78(3 qrs. 4th quotient.

78

00

The several quotients, together, show the answer to be £5 13s. 7½d.

2. Divide 217 tons, 13 cwt. 1 qr. 18 pounds, by 34.

Ans. 6 tons, 8 cwt. 0 qr. 4 lbs. $10\frac{1}{4}$ oz.

3. Divide 187 lbs. 9 oz. 16 pwt. 14 gr. by 58.

Ans. 3 lbs. 2 oz. 17 pwt. $4\frac{2}{3}$ grs.

4. Divide 146 leagues, 2 miles, 6 furlongs, 39 poles, by 39.

Ans. 3 lea. 2 mi. 2 fur. $17\frac{1}{3}$ po.

5. Divide 987 bu. 2 pecks, 6 quarts, 1 pint, 3 gills, by 29.

Ans. 34 bu. 0 pecks, 1 quart, 1 pint, $3\frac{4}{5}$ gi.
 &c 567 yards, 3 quarters, 2 nails, by 52.

Ans. 10 yards, 3 quarters, $2\frac{1}{2}$ nails.

MISCELLANEOUS QUESTIONS.

1. A plantation in the West Indies produced 496 cwt. 2 qrs. 14 lbs. of sugar, and it was put into 63 hhds.; how much did each hogshead hold ? *Ans.* 7 cwt. 3 qrs. 14 lbs. $\frac{3}{4}$.

2. A rich banker in England had 23 bags of gold, containing together, £75346 13s. 9½d.; how much was in each bag ? *Ans.* £3275 18s. 10d. 1 qr. $\frac{7}{23}$.

3. Six men imported from Russia 27 T. 13 cwt. 3 qrs. and 21 lbs. of iron; how much was each man's share ?

4. A turnpike road is to be laid out, extending 127 miles, 6 fur. 30 rods, and divided into 49 shares; how many miles, will each share extend ? *Ans.* 2 miles, 4 fur. 34½ rods.

5. A farmer carried a quart of beer into the field, where 8 men were at work; how much had each man for his portion ?

6. A ship, after sailing 18 days, found she had sailed 35 deg. 40 min. 24 sec.; what did she average per day ?

Ans. 1 deg. 58 min. 54½ sec.

7. A farmer harvested 9 acres of corn, all together, yielding 229 bu. 1 pk. 2 qts. 1 pt.; how much was that to the acre ?

8. Seven men drank a gallon of beer; how much did each man drink ?

9. A farmer has 7 stacks of hay, all of which contain 30 tons; how much is there in each stack ?

10. A cord of wood was divided among 6 poor women; how much had each ?

11. A company of 13 men purchased a package of lottery tickets, and drew 500 eagles, 763 dollars, and 1400 dimes; what was each man's share ?

12. Divide 321 cords, 6 feet, 9 inches, by 43.

Ans. 7 cords, 3 feet, 10½ inches.

13. A butcher bought 19 fat oxen for £173 19s. 11½d.; what did they cost apiece ? *Ans.* £9 3s. 1½d.

REDUCTION.

Q. What is Reduction ?

A. It is bringing numbers from one denomination to another, without altering their value, and is of two kinds, Descending and Ascending.

Q. How are they distinguished ?

A. Reduction *Descending* is bringing large denominations into small, as tons into pounds, years into days, miles into feet, &c. and is performed by multiplication. Reduction *Ascending*

is bringing small denominations into large, as pounds into tons, days into years, feet into miles, &c. and is performed by division.

EXAMPLES FOR MENTAL EXERCISE, SERIES I.

1. How many quarts in 8 gallons? In 12 gallons?
2. How many pints in 4 gallons? In 9 gallons?
3. How many gills in 5 pints? In 2 quarts? in 1 gallon?
4. How many gallons in 32 quarts? In 48 quarts?
5. How many quarts in 16 pints? In 24 pints?
6. How many pecks in 6 bushels? In 8 bushels?
7. How many quarts in 3 pecks? How many pints?
8. How many pecks in 48 quarts? How many bushels?
9. How many bushels in 36 pecks? In 28 pecks?
10. How many quarters in 12 yards? In 9 yards?
11. How many quarters in 12 English ells?
12. How many quarters in 12 French ells?
13. How many quarters in 12 Flemish ells?
14. How many yards in 36 quarters? In 48 quarters?
15. How many Flemish ells in 36 quarters? In 27 quarters?
16. How many ells, English, in 36 quarters? In 45 quarters?
17. How many ells, French, in 36 quarters? In 54 quarters?
18. How many roods in 8 acres? In 12 acres? in 15 acres?
19. How many acres in 48 roods? In 36 roods? in 28 roods?
20. How many ounces in 5 pounds, Avoirdupois?
21. How many ounces in 6 pounds, Troy?
22. How many yards in 6 rods? In 8 rods? in 12 rods?
23. How many feet in 7 yards? In 12 yards?
24. How many yards in 33 feet? In $37\frac{1}{2}$ feet?
25. How many inches in 3 yards? In 4 yards? in 2 yards?
26. How many yards in 6 ells, French? In 4 ells, French?
27. How many yards in 6 ells, English? In 4 ells, English?
28. How many yards in 6 ells, Flemish? In 9 ells, Fl.?
29. How many shillings in 6 pounds, English money?
30. How many pence in 9 shillings? In 12 shillings?
31. How many shillings in 108 pence? In 72 pence?
32. How many pence in 160 farthings? In 180 farthings?
33. How many square feet in 9 square yards?
34. How many square yards in 81 square feet?
35. How many quarters in 6 cwt.? In 9 cwt.? in 12 cwt.?
36. How many cwt. in 44 qrs.? In 36 qrs.? in 50 qrs.?
37. How many furlongs in 9 miles? In 12 miles? in 8 m.?
38. How many miles in 72 furlongs? In 56 furlongs?
39. How many cords of wood in 36 cord feet? In 72 cord?
40. How many scruples in 15 drachms? In 12 drachms?

41. How many pennyweights in 4 ounces? In 7 ounces?
42. How many ounces in 4 pounds, Avoirdupois?
43. How many bushels in 35 pecks? In 27 pecks? in 46 p.?
44. How many feet in a board, 8 feet long and $1\frac{1}{2}$ feet wide?
45. How many solid feet in a box 6 feet long, 3 feet wide, and 2 feet deep?
46. How many square yards of carpeting will cover a room 12 feet long, and 9 feet wide? 9 feet long, and 7 feet wide?
47. How many ounces in 4 pounds Avoirdupois? In 4 lbs. Troy?
48. In 240 buttons, how many dozen? In 2400 how many dozen?

SERIES II.

1. What will 1 yard of lace cost at 3 cents a nail?
2. What will 1 ell French cost at 2 cents a nail?
3. What cost 1 ell English of silver cloth, at 10 cents a nail?
4. What cost 4 Flemish ells of lace at 50 cents a quarter?
5. What will 1 gallon of wine cost at 3 cents a gill?
6. A man bought 1 bushel of corn for one dollar, and sold out for 2 cents a pint; how much did he make?
7. What will 1 ounce of silver be worth, at 5 cents the pennyweight? At $6\frac{1}{4}$ cents the pennyweight?
8. What will 1 pound of cloves cost at $6\frac{1}{4}$ cents an ounce?
9. When cinnamon is worth 64 cents a pound, what must you give for one ounce? For 4 ounces? for 8 ounces?
10. When sugar costs 9 dollars a cwt. what must I give for 1 quarter of a cwt.? For $\frac{1}{2}$ cwt.? for $\frac{3}{4}$ cwt.?
11. What will a carpet cost, sufficient to cover a room 9 feet square, at 1 dollar the square yard?
12. What will a block of Italian marble be worth, that measures 4 feet long, 3 feet wide, and 2 feet thick, at $1\frac{1}{4}$ dollars the solid foot? At 50 cents the foot?
13. A man bought 4 dozen of chairs for 24 dollars; what was that a piece?
14. What will 1 peck of chesnuts bring, if sold at 4 cents a pint?
15. What will a yard of silver wire be worth at 2 cents an inch?
16. What will 2 tons of iron cost, at 4 dollars a cwt.?
17. What cost 2 chaldrons of coal at 25 cents a bushel?
18. A man bought a hog that weighed 5 score, and gave 64 cents a pound; what was the amount?
19. What cost 4 barrels of beef at 4 cents a pound?

REDUCTION DESCENDING.

20. What cost 4 dozen arithmetics at $\frac{1}{2}$ a dollar a piece?
21. Bought 2 boxes of hats, each box containing 2 dozen, at $1\frac{1}{2}$ dollar a hat; what was the amount?
22. How many pages in 4 books, each containing 150 pages?
23. What cost 2 reams of paper at 20 cents a quire?
24. What cost 2 quires of paper at 2 cents a sheet? At 1 cent a sheet? at $\frac{1}{2}$ of cent a sheet? at $\frac{1}{4}$ of a cent?
25. What will an ounce of gold be worth at 6 cents a grain?

REDUCTION DESCENDING.

Q. What is the RULE for Reduction Descending?

A. Multiply the highest denomination given, by that number which it takes of the next lower denomination, to make one of that highest, remembering to add in the next lower denomination, if there be any: then multiply this product in the same manner as before, and thus continue, till you have brought it as low as the question requires.

EXAMPLES.

1. How many pounds in a hhd. of sugar weighing 9 cwt. 2 qrs. 14 lbs.?

$$\begin{array}{r}
 \text{Operation } 9 \quad 2 \quad 14 \\
 \times \text{by } 4 + 2 = 38 \text{ qrs.} \\
 \hline
 38 \\
 \times \text{by } 28 + 14 = 1078 \text{ lbs.} \\
 \hline
 318 \\
 76 \\
 \hline
 \end{array}$$

1078 pounds, *Ans.*

2. In 142 gallons how many pints? *Ans.* 1136.
3. How many farthings in a purse of money, containing £49 19s. 6½d. *Ans.* 47978.
4. How many barley corns will reach round the globe, allowing its circumference to be 25000 miles? *Ans.* 4752000000.
5. How many minutes in a century?
6. How many solid or cubic inches in a solid or cubic block, 12 feet square? *Ans.* 2985984.
- " any minutes and seconds in a circle of 360 degrees. *Ans.* 21600 min. 1296000 sec.
- be 14 years, 120 days, and 13 hours, how many you? *Ans.* 452221200.

9. The diameter of the earth's orbit is 190 millions of miles, and its circumference 3 times its diameter; how many inches does the earth travel in performing its revolution round the sun?
Ans. 36115200000000.

10. In 24 pipes, 1 hhd. 35 gals. 2 qts. how many quarts, pints, and gills?
Ans. 12490 quarts, 24980 pints, 99920 gills.

11. A merchant bought 8 bales of cloth, each containing 6 packages, each package 6 pieces, and each piece 35½ yards; how many yards, quarters, and nails, in the whole?
Ans. 10224 yards, 40896 quarters, 163584 nails.

12. How many square feet in a town 12 miles square?
Ans. 4014489600.

13. In 13 tons, 14 cwt. 3 qrs. 17 lbs. of iron, how many pounds?
Ans. 30789 lbs.

14. In 145 lbs. 8 oz. 14 pwt. 18 grains, how many grains?
Ans. 839394.

15. In 312 moidores, how many pence and farthings?
Ans. 134784 pence, 539136 farthings.

16. In 136 bu. 3 pks. 6 qts., how many pints and gills?
Ans. 8764 pts., 35056 gills.

17. In 436 ells English, how many quarters and nails?
Ans. 2180 qrs., 8720 nails.

18. In 215 lbs. 10 oz. 5 dr. 2 sc. 15 grs., how many grains?
Ans. 1243555.

19. In 352 leagues, 540 inches, how many barley corns?
Ans. 200726100.

REDUCTION ASCENDING.

Q. What is the RULE for Reduction Ascending?

A. Divide the given denomination by that number, which it takes of that denomination, to make *one* of the next higher, then divide this quotient again in the same manner, and thus continue, till you have brought it to the denomination required.

EXAMPLES.

1. In 46846 farthings, how many pounds?
Ans. £48 15s. 11½d. over.

2. In 58464 grains, how many pounds Troy?
Ans. 10 lbs. 1 oz. 16 pwt.

3. In 89876473 seconds, how many days, weeks, and years?
Ans. 1040 d. 5 h. 41 m. 13 sec.; 148 w. 4 d.; 2 y. 44 w.

4. In 94076 grains of gold, how many pounds?
Ans. 16 lbs. 3 oz. 19 pwt. 20 gra.

5. In 498876 grains, how many pounds, Apothecaries weight? *Ans.* 86 lbs. 7 oz. 2 dr. 1 sc. 16 gr.
6. In 49864 shillings, how many dollars and moidores? *Ans.* 8310 dollars, 4s.; 1385 moidores, 4s.
7. In 36784 nails, how many yards? *Ans.* 2299 yds.
8. In 876958 square rods, how many acres? *Ans.* 5480 acres, 3 roods, 38 rods.
9. In 8764934 gills, how many pipes? *Ans.* 2173 pipes, 1 hhd. 43 gals. 1 pt. 2 gi.
10. In 123456 nails, how many English ells? *Ans.* 6172 E. E. 4 qrs.
11. In 876460 farthings, how many pistoles at 22s. each? *Ans.* 829 pistoles, 21s. 7d.
12. In 74846840 square feet, how many square acres? *Ans.* 1718 s. acres, 39 rods, 15½ yds. 5 ft.
13. In 490864 solid inches, how many cords of wood? *Ans.* 2 cords, 28 feet, 112 in.
14. In 94680 feet of rough stone, how many cords? *Ans.* 3156 cords.
15. In 40840 pounds, how many tons? *Ans.* 18 T. 4 cwt. 2 qr. 16 lbs.
16. In 1789464 inches, how many miles? *Ans.* 28 m. 427 yds. 1 foot.
17. In 987563 gills, how many bushels? *Ans.* 3857 bu. 2 pks. 5 qts. 0 pts. 3 gi.
18. In 5603204 seconds, how many degrees and signs?

REDUCTION OF FEDERAL AND STERLING MONEY.

Q. What is a pound sterling of Great Britain valued at, in Federal money?

A. It is valued at \$4,44½; therefore £100 sterling is \$444,44½, and £1000 sterling is \$4444,44½.

Q. How many shillings sterling are equal to one dollar Federal money?

A. Four shillings and six pence.

Q. By what rule can you bring pounds sterling to Federal money?

A. If the given sum consist of pounds only, or of pounds and shillings, multiply the pounds by 40, and add in the shillings, multiplied by 2, (or twice the given number of shillings,) and divide the product by 9; that is, bring your pounds and shillings to sixpences, and divide them by 9, (because 9 six-

pences are equal to 4s. 6d. sterling or one dollar federal money,) and the quotient will be the answer in dollars; if any thing remain, annex ciphers and divide on, and your quotient will be cents and mills.

Q. If the given sum consists of pounds, shillings, and pence, or pence, and farthings, how will you proceed?

A. Reduce the given sum to the lowest denomination mentioned in it, for a dividend; then reduce 4s. 6d. to the same denomination for a divisor; divide, and the quotient will be the answer in dollars; if any thing remain, annex ciphers, divide on, and the quotient will be cents.

Q. How can you bring any sum of federal money, to pounds sterling of Great Britain?

A. Subtract from the given sum one quarter of itself, bring the remainder to shillings (or shillings and pence); divide them by 20, and the quotient will be the answer in sterling pounds, shillings, and pence.

EXAMPLES.

1. In £250 15s. sterling, how many dollars federal money?

$$\begin{array}{r}
 \text{Operation.} \quad \begin{array}{r} \text{\pounds} \quad \text{s.} \\ 250 \quad 15 \\ \hline 20 \end{array} \\
 \hline
 5015 \\
 2 \text{ sixpences} = \text{to } 1\text{s.}
 \end{array}$$

Divide by 9)10030

1114,444—Ans.

2. Bring £150 13s. 9½d. to federal money?

$$\begin{array}{r}
 \text{Operation.} \quad \begin{array}{r} \text{\pounds} \quad \text{s.} \quad \text{d.} \\ 3)150 \quad 13 \quad 9\frac{1}{2} \\ \hline +50 \quad 4 \quad 7\frac{1}{2} \\ \hline 200 \quad 18 \quad 5 \\ 20 \end{array}
 \end{array}$$

Divide by 6)4018

$$\begin{array}{r}
 669,66 \\
 07 = 5 \text{ pence.}
 \end{array}$$

Ans. \$669,73.

REDUCTION.

3. In \$1114,44 cents, how many pounds sterling?

Operation. 4)1114,44
 —278,61

Multiply the dollars by 6 to 835,83
 bring shillings, 6

5010
 +5s.=83 cts.

20)5015

Ans. £250 15s.

4. In £575 18s. 9d., how many dollars, and cents?

Ans. \$2559,72.

5. In \$6666,66, how many pounds sterling?
- Ans.*
- £1500.

6. In £750, how many dollars, and cents?
- Ans.*
- 3333,33½.

7. Bring \$2559,72 into pounds sterling.
- Ans.*
- £575 18s. 9d.

9. In £501 10s., how many dollars and cents federal money?

Ans. \$2228,88,8.

8. In \$669,73, how many pounds sterling?

Ans. £150 13s. 9½d.

MISCELLANEOUS QUESTIONS.

1. What will a hogshead of rum amount to, at 3 cents the glass or half gill?

Ans. \$120,96.

2. A grocer purchased 8 cwt. 3 qrs. 14 lbs. of sugar, for \$96,75, and retailed it out for 12½ cents a pound; did he make or lose by the sale of it, and how much?

Ans. He gained \$27,50.

3. A merchant bought 3 casks of brandy, gauge and outs as follows: 128—4 out, 136—6 out, 114—5 out, at the rate of \$1,35 the gallon, and retailed it out at 25 cents a pint; what did it cost him, and how much did he make by the sale of it?

Ans. Cost \$490,05. He made \$235,95.

4. A merchant in Liverpool drew a bill of exchange on his agent in Providence, for £425 15s. 6d. sterling; how many dollars will pay the draft?

Ans. 1892,33½.

5. A silver smith sold a piece of plate, wt. 2 lbs. 8 oz. 14 pwt. for 6½ cents the pwt.; what was the amount?
- Ans.*
- \$40,87½.

6. How many square feet in the roof of a building, the rafters are 12 feet long, and the jet 25 feet; and how will cover the roof, if 9 shingles cover a square

Ans. { 600 square feet.
 5400 shingles.

7. A gentleman has a cask of cider, containing $136\frac{1}{2}$ gallons, which he wishes to put into bottles, holding $1\frac{1}{2}$ pints each; how many bottles will it require, and what will it come to at $12\frac{1}{2}$ cents a bottle? *Ans.* 728 bottles. Come to \$91.

8. If a stage pass $7\frac{1}{2}$ miles in an hour, how long will it be in going from Boston to New-York, the distance being 250 miles?

Ans. 33 h. 20 min.

9. Bought a load of wood, measuring 6 cord feet, at the rate of $5\frac{1}{2}$ dollars a cord; how much did I pay for it? How much for 3 feet? how much for 1 foot?

Ans. \$4,12 $\frac{1}{2}$ for 6 ft. \$2,06 $\frac{1}{2}$ for 3 ft. 68 $\frac{1}{2}$ cts. for 1 ft.

10. Bought a lot of land, containing 25 acres, 3 roods, 24 rds. and gave 37 $\frac{1}{2}$ cts. for every square yard; what was the amount?

Ans. \$47008,50.

11. A tavern keeper bought 25 bushels of corn at 62 $\frac{1}{2}$ cents the bushel, and retailed it out to his cutomers at 6 $\frac{1}{2}$ cents the quart; how much did it bring as he sold it, and what was his profit?

Ans. Brought 50 dollars. He gained 34 dollars, 37 $\frac{1}{2}$ cts.

12. In 575 dollars, at 6 shillings each, how many Dutch guilders at 2s. 4d. each? *Ans.* 1478 g., and 1s. 4d. over.

13. In 25 hhds. of sugar, each containing 7 cwt. 3 qrs. 14 lbs. how many barrels, each containing 2 cwt. 2 qrs. 14 lbs?

Ans. 75 bbls.

14. In 4960 English crown pieces, how many 4 $\frac{1}{2}$ pennies? How many ninepences? how many half dollars? how many dollars? *Ans.* 5511 dollars. Halves, 11022. Ninepences, 44088. 4 $\frac{1}{2}$ pennies, 88177.

15. What must I give for 9 tons of hewn timber, at 12 $\frac{1}{2}$ cents a foot? *Ans.* \$56,25.

16. How many times will a chaise-wheel, 15 $\frac{1}{2}$ feet in circumference, turn round in running 150 miles? How many times in 300? how many in 900 miles?

Ans. 51096 times in 150 mi. 102193 in 300. 306580 in 900.

17. How many square feet in a room 18 $\frac{1}{2}$ feet long, and 14 $\frac{1}{2}$ wide, and how many yards of painted canvas, 2 feet, 8 inches wide, will cover the floor?

Ans. 272 $\frac{1}{2}$ feet, in the room. 34 yds. 0 qr. 1 $\frac{1}{2}$ na.

18. A druggist, in compounding a specific, made use of 6 lbs. 8 oz. 6 dr. 2 sc. 16 grs. of different ingredients; what will it bring him if he sell it at 2 $\frac{1}{2}$ cents a grain? *Ans.* \$970,40.

19. If a man step 3 feet or 1 yard at each step, how many steps would he take in walking from the equator to the north pole?

Ans. 11008800.

20. What will 25 great gross of gilt buttons cost at 3 $\frac{1}{2}$ cents a button?

Ans. 1512 dolls.

21. The District of Columbia is 10 miles square; how many square acres, square yards, and square feet, does it contain? and if sold at $12\frac{1}{2}$ cents the square foot, what would be the amount?

Ans. { Contents 64000 ac. 309760000 yards.
2787840000 feet. Amount \$348480000.

22. A merchant in Boston, remitted to his agent in London \$3450, in part payment of a debt of £2500 sterling; how much still remains unpaid (in English currency) and how many dollars will pay the balance?

Ans. Unpaid £1723 15s. \$7661,11½ will pay the balance.

23. In 500 dollars, how many quarter dollars, ninepences, dimes, and four-pence-half-pennies, and of each an equal number?

cts. cts. cts. cts.

$25+12\frac{1}{2}+10+6\frac{1}{2}=53\frac{1}{2}$ cents.

Then \$500=50000 cents÷53½ cents.

Ans. 930, and $12\frac{1}{2}$ cents over.

24. A dry goods dealer purchased 4 pieces of cloth, containing, the first, 18 yds. 3 qrs. 2 na., the second, 14 yds. 2 qrs. 3 na., the third, 21 yds. 1 qr. 3 na., and the fourth, 19 yds. 2 qrs. 3 na.; how many nails in all, and how much will the cloth bring at $8\frac{1}{2}$ cents per nail?

Ans. Number of nails 1195. Cloth will bring \$101,57½.

25. A merchant in Baltimore received from his agent in England 150 guineas, at 28s. each, and 725 crowns, at 6s. 8d. each; how many dollars, Federal money, could he get for them all?

Ans. \$1505,55 cts.

26. I bought 3 casks of wine, the first containing 120 gallons, 3 qts. 1 pt., the second 118 gals. 2 qts. 1 pt., and the third 136 gals. 1 qt. 1 pt.; how many pints in the whole, and how many kegs containing $4\frac{1}{2}$ gallons each, will contain the whole?

Ans. 3007 pts. 83 kegs, and 2 g. 1 qt. 1 pt. over.

27. A gentleman has 21 hhds. of tobacco, each 8 cwt. 3 qrs. 14 lbs., and wishes to put it into boxes containing 40 lbs. each; how many boxes must he get?

Ans. 521, and 34 lbs. over.

28. Gen. George Washington was born February 22, 1732, and died December 14, 1799; how old was he when he died, and how many days and hours are in his age, allowing 30 days to the month? *Ans.* His age 67 yrs. 9 mo. 22 dys.; and $67 \times 12 + 9 \times 30 + 22 = 24412$ dys. = 585888 hours.

29. In 59 half Johannes, 37 moidores, 45 guineas, 63 pistoles, and 24 English crowns, how many dollars, at 6s. each?

Ans. \$1161, 4s.

30. A merchant sold 140 bbls. of salt at 1 dollar, $37\frac{1}{2}$ cents a bushel, and took his pay in fish at 2 dollars per quintal; what did it amount to, and how many quintals of fish paid for it. *Ans.* Amounted to \$192,50; $96\frac{1}{2}$ quintals paid for it.

31. A merchant bought 4 pieces of silk, each piece containing $27\frac{1}{2}$ yards, at $87\frac{1}{2}$ cents a yard, and paid for it in domestic shirtings, at $12\frac{1}{2}$ cents a yard; what did the silk amount to, and how many yards of shirting will pay for it?

Ans. Amounted to \$96.25. 770 yds. of shirting paid for it.

32. How many cubic feet in a load of wood 8 feet long, 4 feet high, and $3\frac{1}{2}$ feet wide?

Ans. 112 solid feet.

33. A merchant failing in trade, was able to pay only $37\frac{1}{2}$ cents on a dollar; how much must I receive for a debt of 250 dollars? how much on 384 dollars? how much on 765 dollars?

Ans. On 250, \$93.75. On 384, \$144. On 765, \$286.87 $\frac{1}{2}$.

34. A man bought 359 kegs of tobacco, at 9 dollars per keg, 654 bbls. of beef, for 8 dollars per barrel, 9 bags of coffee, at 29 dollars per bag; in return he gave 3 hhd. of rum, at 180 dollars a hogshead, 473 cwt. of sugar, at 8 dollars per cwt.; how much did he then owe?

Ans. 4400 dollars.

35. How much wine, at \$1.25 a gallon, must I give for 750 bushels of salt, at $87\frac{1}{2}$ cents a bushel?

Ans. 525 gallons.

36. A grocer bought 4 hhd. of sugar, each weighing 7 cwt. 2 qrs. 14 lbs. for \$90 per hhd., and retailed it out for $12\frac{1}{2}$ cents a lb.; did he gain or lose, and how much?

Ans. Gained \$67.

37. If a man's age be threescore years and ten, how many days, hours, minutes, and seconds, has he lived?

Ans. 25567 $\frac{1}{2}$ days. 613620 hours. 36817200 minutes. 2209032000 seconds.

38. What must I give for 25 tons of iron, at $6\frac{1}{2}$ cents a pound?

Ans. 3500 dollars.

39. A goldsmith sold a quantity of silver plate, weighing 7 lbs. 10 oz. 13 pwt. 14 grs. at the rate of $3\frac{1}{2}$ mills the grain; what was the amount?

Ans. \$159.06, 1 mill.

40. A gold digger found a lump of gold, weighing 9 lbs. 8 oz. 17 pwt. 20 grs., which was worth $3\frac{1}{4}$ cents a grain; what was the value of the lump?

Ans. \$1823.51.

41. A merchant bought 5 hhd. of sugar, each weighing 7 cwt. 3 qrs. 14 lbs. at $9\frac{1}{4}$ cents the pound; what was the whole amount?

Ans. \$429.97 $\frac{1}{2}$.

42. There is a mill-pond which measures 375 yds. in length, and 225 yds. in breadth, and is, on an average, 8 feet deep; how many cubic inches of water does it contain, and allowing 231 cubic inches to the gallon, how many gallons in the pond; and if every pint weigh a pound, how many tons does the whole mass weigh?

Ans. Cubic inches, 10497600000. Galls. 45444155. 162300 tons. 12 cwt. 0 qrs. 8 lbs.

43. A merchant purchased 5 packages of cloth, each package containing 6 pieces, and each piece $36\frac{1}{2}$ yards; what must he pay for it at the rate of 1 dollar $37\frac{1}{2}$ cents per ell Flemish?

Ans. \$2007.56

44. How many table spoons, each weighing 1 oz. 8 pwt. 6 grs. can be made from 4 ingots of silver, weighing 2 lbs. 8 oz. 13 pwt. 16 grs.?

Ans. 23 spoons, and 94 grains over.

45. What must I give for 19 loads of hewn timber at 12½ cents a solid foot?

Ans. \$118,75.

46. The national debt of England is 800 million pounds sterling; how many dollars will pay the debt? If 50 men were engaged in counting the money, and were to count \$50 a minute, each, and count 12 hours a day without interruption, how long would it take them to count the whole debt? And if every \$100 gained 6 dollars interest in a year, how much interest will be due on the debt every year? How much a day? How much an hour? How much a minute? And if 16 dollars weigh one pound avoirdupois, allowing 2000 pounds to the ton, how many tons will the whole weigh. And how many baggage wagons, each carrying 1½ tons, will it require to transport it. And allowing 4 horses to each wagon, how many horses will it require to draw them. Allowing each team to occupy 10 yards, how far will the whole procession extend?

Ans. £800000000 sterling is equal to \$3555555555½.

It would require 5 years, 150 days, 3 hours, 42 minutes, 13 seconds to count it.

Interest for one year is 213333333½ dollars.

Interest per day, 584474 dollars, 88 cents.

Interest per hour, 24353 dollars, 12 cents.

Interest per minute, 405 dollars, 88 cents.

The whole would weigh 11111 tons, 222 lbs.

It would require 74074 wagons, 222 lbs. left.

It would require 296,296 horses to draw them.

The whole procession would reach 420 miles, 7 furlongs.

47. A merchant imported 25 hhds. of rum, containing 118 galls. each, which sold for 87½ cts. the gall.; how much would he gain by retailing the whole for 6 cts. a gill? *Ans.* \$3082,75.

48. A butcher bought 50 fat hogs, each weighing 13½ score, and, after deducting ½ part for lard, heads, and feet, wishes to put the pork into barrels; how many bbls. will it require, and what will the whole come to at \$13½ a bbl., and reckoning the lard, heads, and feet, together with the odd pounds of pork, at 6½ cents a pound?

Ans. { No. of bbls., 59, and 12½ lbs. over.
Amount, 902 dollars, 75 cents.

49. If 25 gallons a minute, can be pumped from a cistern containing 75000 gallons, how long will it take to pump it dry?

Ans. 50 hours; or 2 days, and 2 hours.

50. If a man spend 2 dollars, 75 cents a day, through the year, how much money will he have left at the year's end; how much income be? *Ans.* 1753 dolls. 75 cts.

51. A gentleman hired a mason to build a cellar wall which contained 150 cords of rough stone, and paid for the stone and building, at the rate of $6\frac{1}{4}$ cents per solid foot; how many solid feet did the wall contain, and how much did the stone and the laying of it cost him?

Ans. { No. of feet, 4500.
Amount, \$281.25.

52. Bought 25 pipes of wine, each containing 128 gallons, at 256 dollars a pipe; how many quarter casks of $31\frac{1}{2}$ gallons each will contain the whole, and how must I sell it per quarter cask, to make 1600 dollars by the speculation?

Ans. { 101 casks, $18\frac{1}{2}$ gallons over.
Must sell it for \$79.20, 7 per qr. cask.

53. A man bought 15 casks of cider, each 126 gallons; how many barrels, each $31\frac{1}{2}$ gallons, and how much did he pay for it at the rate of 2 dollars, $37\frac{1}{2}$ cents a barrel?

Ans. { No. of barrels, 60.
Amount, 142 dolls. 50 cts.

54. Bought 3 pipes of wine, containing 125, 124, and 122 gallons, for 512 dollars; what did it cost a gallon, and how must I sell it a gallon to gain \$92.75 on the whole?

Ans. Cost \$1.38 a gal. I must sell at \$1.63 a gal.

55. If a gentleman's income be 1836 dollars a year, and he spends 3 dollars, 49 cents a day, how much will he have saved at the year's end?

Ans. 562 dollars, 15 cents.

56. Bought a bale of cloth, containing 240 yards, for 600 dollars; how must I sell it per yard to gain 120 dollars on the whole?

Ans. 3 dollars.

57. Bought a pipe of wine for 327 dollars, 75 cents, and paid for it at the rate of 2 dollars, $37\frac{1}{2}$ cents a gallon; how many gallons did the pipe contain?

Ans. 138 galls.

58. A merchant in Providence, remitted to his correspondent in New-York, 1450 dollars, requesting him to purchase in equal quantities, Hyson tea, at $87\frac{1}{2}$ cents a pound; Young Hyson at $62\frac{1}{2}$ cents a pound, and Souchong at 50 cents; how many pounds of each kind can he purchase with the money? how many lbs. in all; how many chests, each weighing 62 lbs.?

Ans. 725 lbs. of each: 2175 lbs. in all: and 35 chests.

59. If a man drink 3 glasses of rum every day, at the cost of 3 cents a glass, how much will he drink in 20 years; how much will it cost him in that time; how many acres of land, at 12 dollars an acre, could he purchase for the money?

Ans. He will drink 342 galls. 0 qts. 1 pt. 2 gills. It will cost him \$657, and would purchase $54\frac{1}{2}$ acres of land.

60. How many yards of carpeting, that is $\frac{1}{4}$ yard will cover the floor of a room, that is 5 yards long, and in width?

Ans. 26

61. How much time would a man redeem, by rising one hour earlier every day, than his usual custom, if he continued from the age of 21, to that of 60 years; and allowing his time to be worth $12\frac{1}{2}$ cents an hour, how much would he add to his fortune by so doing?

Ans. { He would redeem 593 days, 3 hours.
And would add to his fortune, \$1779,37 $\frac{1}{2}$.

62. A farmer harvested 25 acres of corn that yielded 46 bushels to the acre; what is the whole worth at $87\frac{1}{2}$ cents the bushel? and allowing 2150 cubic inches to the bushel, how many cubic feet must a bin contain to hold it all?

Ans. { Amount, 1006 dollars, 25 cents.
No. of feet in the bin, 1430 : 1460 inches.

63. A merchant bought 75000 hoops at \$18,50 a thousand; 120000 shingles at \$4,25 a thousand; and 4650 staves at \$2,37 $\frac{1}{2}$ a hundred; and paid in part, with 575 gallons of molasses at $37\frac{1}{2}$ cents a gallon, and the balance in cash; how much money was due on the balance. *Ans.* \$1792,30 $\frac{1}{2}$.

64. If 4 men can row a boat 10 miles an hour in still water, how long will they be in going from New-York to Albany, a distance of 160 miles, allowing the current to retard them 2 miles an hour, and the wind and tide to advance them half a mile an hour? *Ans.* 18 h. 49 m. 24 $\frac{1}{2}$ sec.

RULE OF THREE.

Q. On what established principle or law of Arithmetic is the Rule of Three founded?

A. On the principle or law of proportion.

Q. What is to be understood by the law of proportion?

A. That all like quantities, whether known or unknown, bear a certain proportion to each other.

Q. What then are we taught by this rule?

A. We are taught by having *certain quantities* given, bearing a *known proportion* to each other, to find *other unknown* quantities, which shall bear a *like proportion* to *some of the given quantities*.

Q. How many terms are given in the RULE OF THREE?

A. Three terms are always given, to find a fourth, which will bear the same proportion to one of the given terms, as the other two bear to each other.

2. How many kinds of Rule of Three are there?

1. Three Direct, and Rule of Three Inverse.

Q. What proportion do the terms bear to each other, in the Rule of Three Direct?

A. The fourth term, or answer sought, will bear the same proportion to the third term given, as the second bears to the first.

Q. What proportion do the terms bear to each other, in the Rule of Three Inverse?

A. The fourth term, or answer sought, bears the same proportion to the second term given, as the first term bears to the third.

Q. How are we taught to answer questions by this rule?

A. By stating the question, and saying, as the *first* term : is to the *second* :: so is the *third* term : to the *fourth* or answer.

Q. How is the *first* term distinguished from the other given terms?

A. The first term is always that which *bought*, *cost* or *produced* one of the other terms.

Q. How is the *second* term distinguished?

A. It is that which *was caused*, *bought* or *produced* by the *first* term, and is always of the same name or kind as the *fourth* term or answer sought.

Q. How is the *third* term known?

A. It is always of the same name or kind with the first; and is that which must *buy*, *cause* or *produce* the fourth term or answer. The third term is also a demand, and may be known by these or the like words, viz: What will, what cost, how much, how far, how long, &c. before it.

Q. How then do you state questions in this rule?

A.	}	1st	{	bought,	}	the	2d	{	what	}	3d	{	buy,	}						
Say															term	cost, or	term	will	term	cost, or
If the															\$6	produced	12 yds.	the	\$9	produce.

Q. If the terms consist of several denominations, how do you proceed?

A. Reduce the *FIRST* and *THIRD* terms to the lowest denomination mentioned in *either*: then reduce the *SECOND* term to the lowest denomination mentioned in *that* term; and if the proportion be *direct*, multiply the *second* and *third* terms together, and divide their product by the *first* term, and the quotient will be the fourth term or answer, in the same denomination you left the second term in, and must be brought to the denomination required by the question.

Q. If the proportion be *Inverse*, how do you proceed?

A. Multiply the first and second terms together; divide the product by the third term, and the quotient will be the answer in the same denomination in which you left the second term, and must be brought to the denomination required by the question.

Q. How do you distinguish the Rule of Three Direct from the Rule of Three Inverse?

A. If the third term be *greater* than the first, and require the fourth term or answer to be *greater* than the second; or if the third term be *less* than the first, and require the fourth term to be *less* than the second, the question belongs to the Rule of Three Direct.

Q. How can you distinguish the Rule of Three Inverse?

A. If the third term be *greater* than the first, and require the fourth term or answer to be *less* than the second; or if the third term be *less* than the first, and require the fourth term to be *greater* than the second, the question belongs to the Rule of Three Inverse.

NOTE.—Although this rule is seldom used in business, and is, by many modern authors left out of their works, still, as so large a proportion of arithmetical calculations are founded upon its principles, and as *system* in the order of arrangement is a prime object in this work, I have thought best to give it a place in the order it has so long maintained in productions of this kind.

EXAMPLES FOR MENTAL EXERCISE, SERIES I.

1. If 1 yard of cloth cost 4 dollars, what will 6 yards cost?
2. If 8 yards cost 48 dollars, what will 1 yard cost?
3. If 6 yards cost 3 dollars, what will 8 yards cost?
4. If 9 yards cost 6 dollars, what will 12 yards cost?
5. What number will bear the same proportion to 4, that 3 bears to 2?
6. If a man can travel 15 miles in 3 hours, how many miles can he travel in 4 hours?
7. If 2 men can do a job of work in 6 days, in how many days can 4 men do the same?
8. If 7 men can build a house in 6 weeks, in how many weeks can 6 men build the same?
9. If an ell French of lace cost 6 dollars, what will 1 yard of the same cost?
10. If 1 yard of cloth cost 8 dollars, what must I give for an ell Flemish of the same?
11. If 7 bushels of corn cost \$3½, what will 9 bushels cost?
12. If 5 sheep cost 7 dollars, what will 8 sheep cost?
13. If 3 men can mow a meadow in 3 days, how many days will 9 men be in mowing the same?
- many bushels of oats, at 25 cents a bushel, must I
- shels of corn, at 75 cents a bushel?

RULE OF THREE.

119

15. A. can walk 30 miles in a day, and B. can walk 35 miles in the same time; now if A. set out 2 days before B. how many days before B. will overtake A.?

16. If 3 engines can empty a reservoir in 60 minutes, how long will 5 engines be in emptying the same?

SECOND SERIES OF MENTAL EXAMPLES.

1. What number will bear the same proportion to 7, that 14 bears to 8?

2. What number will bear the same proportion to 9, that 3 bears to 4?

3. As 5 is to 9, so is 6 to what number? What inversely?

4. As 3 is to 1, so is 8 to what number? What inversely?

5. As 2 is to 7, so is 6 to what number? What inversely?

6. As 1 is to 9, so is 5 to what number? What inversely?

7. As 2 is to 12, so is 4 to what number? What inversely?

8. As 3 is to 15, so is 2 to what number? What inversely?

9. As 4 is to 5, so is 7 to what number? What inversely?

10. As 6 is to 8, so is 3 to what number? What inversely?

11. As 7 is to 10, so is 1 to what number? What inversely?

12. As 8 is to 11, so is 9 to what number? What inversely?

13. As 9 is to 12, so is 4 to what number? What inversely?

14. As 10 is to 3, so is 11 to what number? What inversely?

15. As 11 is to 2, so is 10 to what number? What inversely?

16. As 12 is to 4, so is 11 to what number? What inversely?

17. If $\frac{1}{4}$ wide require 4 yards, what will $\frac{1}{2}$ wide require?

18. If $\frac{1}{2}$ wide require 2 yards, what will $\frac{1}{4}$ wide require?

19. If 5 men can earn 8 dollars in 1 day, what will 7 men earn in the same time?

20. Five men, in dividing a sum of money, had each 7 dollars; now if the same sum had been divided among 7 men, how many dollars would each have had?

21. If a hare start 40 yards before a hound, and the hound gain 6 yards a minute, how long will the chase last?

22. A certain quantity of provision will last 5 men 3 months; how long will it last 8 men?

23. If 5 men will eat 7 pounds of meat in a given time, how many pounds will 8 men eat in the same time?

24. A cistern has 2 faucets, either of which will empty it in 45 minutes; if both be set running together, in what time will they empty it?

25. A cistern has 2 faucets, one of which will fill it in 30 minutes, the other will empty it in 60 minutes; if both be set running, in what time will it be filled?

EXAMPLES FOR EXERCISE ON THE SLATE.

1. If 4 yards of cloth cost 6 dollars, what will 16 yards cost? yds. \$ yds.

Operation: state the question and say, if $4 : 6 :: 16$
6

4)96

Ans. 24 dolls.

2. If 24 dollars will buy 16 yards of cloth, how many yards will 6 dollars buy?

\$ yds. \$

Statement: if $24 : 16 :: 6$.

Ans. 4 yards.

3. If 6 dollars will buy 4 yards of cloth, how many yards can be bought for 24 dollars?

Ans. 16 yards.

4. If a piece of silk, containing 24 yds., cost \$18, what must be given for 4 pieces, each containing 18 yds.?

Ans. \$54.

5. If I give 3 dollars for 7 yards of cloth, how many yards of the same can I have for 75 dollars?

Ans. 175 yds.

6. A farmer hired a laborer for 1 year, and was to give him 144 dollars; but his health failing him, he was able to work only 18 weeks; how much ought the farmer to pay him, allowing 52 weeks to the year?

Ans. \$49,846 mills.

7. A merchant bought 4 pieces of English broadcloth, each piece containing $17\frac{1}{2}$ yards, at the rate of \$4,50 an ell; how much was the whole amount?

Ans. 252 dollars.

8. A man of war, with a crew of 350 men, was provided with 175 barrels of provision, for a cruise of 9 months; but it was found necessary to increase the complement of men to 500; how many barrels of provision must be added to those already provided, in order to supply the whole number?

Ans. 75.

9. If 75 cents will buy 7 pounds of sugar, how many pounds can be purchased for 6 dollars?

Ans. 56 pounds.

10. If a man travel 35 miles in 12 hours, how far would he go in the month of June, travelling at the same rate, for 16 hours each day?

Ans. 1400 miles.

11. If a pipe of Madeira wine, containing 118 gallons, cost \$236, what must be given for 75 quarter casks, each containing $31\frac{1}{2}$ gallons, at the same rate?

Ans. 4725 dollars.

12. If 50 gallons of water fall into a cistern containing 230 galls. in an hour, and by a pipe in the cistern 35 galls. run out hour, in what time will it be filled?

Ans. 15 hours, 20 m.

13. A cistern has 3 faucets; the first will empty it in 15 second, in 45; and the third, in 90; in what time running together, empty it?

Ans. 10 minutes.

14. A. having stolen a horse from B., starts off with him at the rate of 40 miles a day; B. getting intelligence of his direction 2 days after, pursues him at the rate of 55 miles a day; how many days must B. travel before he overtakes A. and how far will he have gone? *Ans.* He must travel 5 days, 8 h.

Ans.) We must travel 5 days, 8 h.
) We'll have gone 293½ miles.

15. A man has 20 horses, that eat a peck of grain each, a day; how many bushels must he procure on the first day of January, to last them till the first day of April, leap year excepted?

Ans. 450 bushels.

Ans. 459 inches.

16. Bought 6 pieces of French cloths, each containing 24
ells, at \$3.37½ an ell: how must I sell it per yard, in order to
make \$62.50 on the whole? *Ans.* \$2.533 mills.

Ans. \$2.533 mills.

17. The supercargo of a vessel sold his cargo in Havana for \$3750, and laid out the money in molasses, at the rate of \$1.25 a runlet, of 18 gallons; how many gallons did he purchase, and how many hds. of 118 gallons each, must he have procured to hold it? (Purchased 54000 gallons.)

Ans. (Purchased 54000 gallons.
(457 hhds. and 74 gallons.

18. If a man, whose estate is worth \$1450, pay a tax of \$12,621, how much must that man pay, whose estate is worth 3780 dollars?
Ans. \$32,912 milis.

Ans. \$32,912 mil's.

19. There is a steeple, which, on the 20th of September, at 12 o'clock, M., will cast a shade 125 feet on the ground, and a 14 foot pole, at the same hour, will cast a shade 9 feet; how many feet is the steeple in height? *Ans.* 194 feet, $5\frac{1}{2}$ in.

Ans. 194 feet, $5\frac{3}{4}$ in.

RULE OF THREE INVERSE.

1. If 15 men can do a piece of work in 30 days, how long will it take 50 men to perform the same? *Ans.* 9 days.

Ans. 9 days.

2. If 50 men must be employed 9 days, in doing a job of work, how long must 15 men be employed to perform the same? *Ans.* 30 days.

Ans. 30 days.

3. If 35 boards, 9 inches wide, will lay the floor of a room, how many boards of 6 inches wide, will cover the same space ?

Ans. $52\frac{1}{2}$ boards.

4. How many bushels of oats, at $37\frac{1}{2}$ cents a bushel, must be given for 75 bushels of corn at $87\frac{1}{2}$ cents a bushel?

Ans. 175.

5. A merchant bartered 25 yards of broadcloth at \$1,62½ a yard, for domestic cotton at 12½ cents a yard; how many yards of cotton did he receive? *Ans.* 925 yards.

Ans. 925 yards.

6. How many yards of carpeting, that is $\frac{1}{4}$ of a yard will cover a room 6 yards in length, and $\frac{1}{4}$ in breadth?

Ans. 32

7. How much silk, $\frac{3}{4}$ ths of a yard wide, will it require to line a cloak, made of 9 yards of silk that is $\frac{1}{4}$ ths of a yard wide?

Ans. 21 yards.

8. A man left his estate by will, to 5 of his children, each of whose portion was 4750 dollars; but the will being afterwards broken, the whole estate was divided equally among his 9 children; what was each one's share? *Ans.* \$2638,88 $\frac{1}{2}$.

9. A certain quantity of provision will last an army of 25000 men, 90 days; how many men will the same provision keep for one year? *Ans.* 6164 $\frac{1}{2}$.

PROMISCUOUS AND PRACTICAL QUESTIONS.*

1. A merchant bought 6 pieces of cloth, and paid at the rate of \$5 for 8 yards; and sold the same at the rate of \$4 for 5 yards, by which he made \$10,50; how many yards in the 6 pieces? *Ans.* 60 yards.

2. What must I give for 3 hhds. of sugar, each weighing 8 cwt. 1 qr. 12 lbs., at \$7,26 a cwt.? *Ans.* \$182,018 mills.

3. If I pay 6 dollars for the use of \$100 for one year, what must I pay for the use of \$736,75 for the same time? *Ans.* \$44,205.

4. A merchant owed me two notes; one of \$387,94, and the other of \$576,87, besides \$218,25 on book account. On the first note were two endorsements; one of \$46,62, and the other of \$65,47; on the second note was one endorsement of \$137,75: the merchant failing, I agreed to receive 62 $\frac{1}{2}$ cents on the dollar; how much did I receive on my notes, and how much did I lose? *Ans.* { I received \$583,26.
And lost \$349,96.

5. What will 20 tons of iron amount to at 8 cents the pound, reckoning 2000 lbs. to the ton? *Ans.* \$3300.

6. Bought a farm, containing 435 acres, 3 roods, and 25 rods, for which I gave \$13,50 an acre; what did the farm cost me? *Ans.* \$5884,73 $\frac{1}{2}$.

7. A merchant bought 4 pipes of brandy, containing 126, 118, 134, and 125 gallons, at \$1,37 $\frac{1}{2}$ a gallon; paid freight from New-York, and other expenses, amounting to \$12,50: by accident 15 gallons leaked out; what did the whole amount to, and how must he sell it per gallon, to make \$35 on the purchase? *Ans.* { Whole amount \$704,12 $\frac{1}{2}$.
Must sell it for \$1,514 mills per gal.

better, the scholar may be permitted to answer these the Rule of Three, or by any of the preceding rules, convenient and expeditious.

8. Suppose a gentleman has an income of 500 English guineas, how much can he spend daily, and lay up \$2000 a year?

Ans. \$3 65 $\frac{1}{4}$.

9. If 1000 men are in a garrison, and their provisions are calculated to last them 5 months, how many men must leave the garrison, in order that the provisions may sustain the remainder 8 months?

Ans. 875 men.

10. A corporation, possessing a capital of \$45000, find it necessary to assess a tax of \$7450, on the capital stock: how much must I pay, if I own 7500 dollars of the stock, and how much is the tax on a dollar?

Ans. I must pay \$1241.66 tax.
On a dollar 16 $\frac{2}{3}$ cents.

11. A goldsmith sold a piece of plate for \$32.50, at the rate of \$1.25 the oz., what was the weight of it?

Ans. 2 lb. 2 oz.

12. Bought 14 dozen pair of stockings, at 1 dollar 12 $\frac{1}{2}$ cents a pair; what was the amount?

Ans. 189 dollars.

13. A man sold his farm, containing 235 acres, 3 rods, 20 rods, for 27 dollars, 62 cents an acre: what was the amount?

Ans. 6514 dollars, 86 $\frac{1}{2}$ mills.

14. If a box of sugar, weighing 4 cwt. 3 qrs. 14 lbs., cost \$28.50, what must be given for 5 boxes, each weighing 3 cwt. 2 qrs. 21 lbs., at the same rate?

Ans. \$107.788 mills.

15. A grocer bought 45 kegs of butter, weighing, in gross, 1875 lbs., and was allowed 16 lbs. tare on every 100 pounds; what was the neat weight of butter, and what did it amount to at 16 $\frac{1}{2}$ cents per lb., and how many bushels of salt will pay for it, at 62 $\frac{1}{2}$ cents the bushel?

Ans. Neat weight of butter, 1575 lbs. Amount \$259.87 $\frac{1}{2}$, and 415 bush. 3 $\frac{1}{2}$ pks. of salt.

16. Bought 6 pieces of cloth, each 24 $\frac{1}{2}$ yards, for \$118.50; what did it cost a yard?

Ans. 80 cents, 6 mills.

17. A man owned $\frac{1}{3}$ of a manufacturing establishment, which cost \$45750, but the company being obliged to sell it at auction, it brought only \$31575; how much was his share of the proceeds, and how much was his loss from the original amount?

Ans. His share was \$11840.62 $\frac{1}{2}$; his loss was \$5315.62 $\frac{1}{2}$.

18. A farmer has a large meadow, which has always required the labor of 6 men, 8 days, to mow it; but, wishing this year to have it mowed in two days, he wants to be informed how many men he must employ; can you tell him?

Ans. 24 men.

19. A manufacturer has broadcloth, worth, in cash, \$4.50 a yard, which he barter with a merchant for indigo, worth, in cash, \$2.62 $\frac{1}{2}$ per pound; but, in barter, the merchant will have 5 dollars a yard for his cloth; how must I chant prize his indigo, to meet the price of the cloth?

Ans. 2 dollars, 4

20. Suppose 2000 men had been supplied with bread, sufficient to last 12 weeks, allowing each man 14 oz. a day, but on examination they find 105 barrels, each containing 200 pounds, wholly spoiled; what must be the allowance of each man, in order that the remainder may last the same length of time that was first intended? *Ans.* 12 oz. a day.

21. If the earth revolve 366 times in 365 days, how much time is taken for each revolution?

Ans. 23 h. 56 min. 3 sec. 56'' $\frac{1}{2}$.

22. A merchant, owning $\frac{1}{4}$ of a vessel, sold $\frac{1}{8}$ of his share for 1080 dollars, 66 cents; what is the worth of the whole vessel? *Ans.* 2026 dollars, 23 $\frac{1}{2}$ cts.

PRACTICE.

Q. What is Practice?

A. It is a contraction of the Rule of Three Direct, when the first term is a unit or one.

Q. How are you taught to answer questions by the Rule of Practice?

A. By dividing the price into such even or aliquot parts of an integer, or whole number, as may be most convenient, and dividing the quantity by such even parts, and adding the several quotients together, to find the total amount or answer.

Q. What do you understand by the "aliquot part" of any number?

A. It is such an even part, as being taken a certain number of times, will exactly produce the given quantity; as 25 is the aliquot part of 100; for if 25 be taken 4 times, it will make just 100. So 12 $\frac{1}{2}$ cents is an aliquot part or $\frac{1}{8}$ of a dollar; for if 12 $\frac{1}{2}$ cents be taken 8 times, they will make just 1 dollar.

Q. How can you find what part, any given number is, of any other larger given number?

A. By dividing the larger number by the smaller, and if it be contained an even number of times, the quotient, written as a denominator, under a unit for a numerator, will show the aliquot part.

Q. If the smaller number is not contained an even number of times (without a remainder) in the larger number, how do

part?

er number for a numerator, over the
or, and it shows the part.

EXAMPLES.

1. What part of 75 is 25 ?
Ans. $\frac{1}{3}$, because 25 is contained 3 times in 75.
2. What part of an acre, is 20 rods ?
Ans. $\frac{1}{8}$.
3. What part of a ton, is 11 cwt. ?
Ans. $\frac{11}{20}$.
4. What part of a bushel, is 13 quarts ?
Ans. $\frac{13}{8}$.

TABLE OF ALIQUOT OR EVEN PARTS.

[illegible]

EXAMPLES FOR MENTAL EXERCISE, SERIES I.

1. If a yard of cloth cost 6 dollars, what will 2 quarters cost? What will 1 quarter? what will 2 nails? 1 nail?
 2. What part of a yard is 2 nails? What part is 1 nail?
 3. At 16 shillings a yard, what will 2 nails be? 1 nail?
 4. At 1 dollar a yard, what will 2 nails be? 1 nail?
 5. What part of a bushel is 1 peck? $\frac{1}{2}$ peck? 2 quarts?
 6. At \$1.50 cents a bushel, what is half a bushel? 1 peck?
- What is half a peck? what 2 quarts?
7. What part of a gallon is 1 quart? 2 quarts? $\frac{1}{2}$ pint?
 8. At 2 dollars a gallon, what will 1 quart be? 1 pint?
 9. What part of a pound is 8 ounces? 4 ounces? 2 ounces?
- 1 ounce?
10. At 1 dollar a pound, what is 8 ounces? 4 ounces?
 11. At 64 cents a pound, what will 4 ounces be? 1 ounce?
 12. At 32 cents a pound, what will 1 ounce be? $\frac{1}{2}$ ounce?
 13. What part of an acre, is 40 rods? 20 rods? 10 rods?
 14. At 16 dollars an acre, what will 40 rods be? 20 rods?
 15. At 20 dollars an acre, what will 60 rods be worth?
 16. At 8 cents a pound, what is 1 ounce worth?
 17. What part of a cord of wood is 4 feet? 2 feet? 1 foot?
 18. At 6 dollars a cord, what will 4 feet be worth? What will 2 feet? what will 6 feet? 1 foot? 7 feet?
 19. At 8 dollars a cord, what will 4 feet be worth? What will 1 foot? 5 feet? 2 feet? 6 feet? 3 feet? 7 feet?
 20. At 20 cents a yard, what will 1 nail be worth?
 21. At 24 cents a pound, what will 2 ounces be worth?

EXAMPLES FOR MENTAL EXERCISE, SERIES II.

1. What part of a year is 6 months? 4 months? 3 months? 2 months? 1 month? $\frac{1}{2}$ month? 8 months? 9 months?
 2. If a man can earn 100 dollars a year, what will that be for 6 months? What for 3 months? what for 9 months?
 3. At 150 dollars a year, what will 4 months be? What will 1 month? what will 7 months?
 4. At 30 dollars a month, what will 10 days wages be? What will 6 days? what will 5 days? what will 3 days?
 5. At \$24 a month, what will 8 days wages be? What will 6 days be? what will 14 days? what will 9 days?
 6. If I agree to give a man \$1.50 cents a day, and he works $\frac{1}{2}$ of the time, what must I pay him? What for $\frac{1}{4}$?
- At 6 dollars a yard, what must I give for 2 yards, 2 qrs.

what will 1 cord and 6 feet of wood be?

9. At 48 cents a gallon, what must I give for 2 gallons and 1 quart?

10. At 28 cents a pound, what will 1 pound and 6 ounces be worth?

11. Bought 6 ounces of sewing silk, at 8 dollars the pound; what was the amount? What will 2 pounds and 5 oz. be?

12. At 9 dollars the cwt., what must I give for 2 cwt. 2 quarters, 14 pounds?

13. A lady bought 2 yards, 1 quarter, 1 nail of lace, at 2 dollars a yard; what was the amount? What at \$4 the yd.?

14. A man bought 14 bushels, 2 pecks, and 4 quarts of salt, at 1 dollar the bushel; what was the amount?

15. Bought a loaf of sugar, weight 5 pounds, 10 ounces, at 20 cents a pound; what was the amount? What at 16 cts.?

16. Bought 1 dozen and 9 geographies, at 10 dollars a doz.; what was the amount;

17. If a laborer can earn 20 cents an hour, what must you pay him for 3 hours and 45 minutes?

18. If a board be 8 feet long, and 9 inches wide, how many square feet does it contain? How many in 3 boards?

19. How many square feet in a board 16 feet long, and 10½ inches wide?

20. What will 4 acres, 2 roods, and 20 rods of land amount to, at 12 dollars an acre?

21. What will 1 quarter and 1 nail of lace come to, at 1 dollar 60 cents a yard?

EXAMPLES FOR THE SLATE, CASE FIRST.

Q. What is the first case in Practice?

A. When the price of one yard, pound, &c. is an even part of a dollar.

Q. What is the RULE in this case?

A. Write down the number of pounds, yards, &c. as so many dollars, then divide them by the even parts of a dollar contained in the price, and the quotient will be the answer in dollars and parts of dollars.

EXAMPLES.

1. What cost 148 yards of cloth, at 25 cents per yard?

Operation: write down the yards as so many dollars.

25 cents is $\frac{1}{4}$ of a dollar. $\frac{1}{4}$ 148 dollars.

Ans. 37 dollars.

2. What must be given for 37½ yards of ribbon
yard? Ans. \$4

3. What will $315\frac{1}{2}$ yards of cloth come to, at 2 shillings a yard?
Ans. \$105,25 cents.
4. Bought 3 pieces of cloth, each containing $27\frac{1}{2}$ yards, at 1 shilling a yard; what was the amount?
Ans. \$13,75.
5. What cost 136 bush. of oats, at 3s. a bush.?
Ans. \$68.
6. Bought 5 pieces of ribbon, each containing $21\frac{1}{2}$ yards, at 20 cents a yard; what was the amount?
Ans. \$21,25.
7. What will a great gross of buttons come to, at 50 cents a dozen?
Ans. \$72.
8. Purchased 2146 pounds of cheese, at $12\frac{1}{2}$ cents a pound; what was the amount?
Ans. \$268,25 cents.
9. What cost 275 bushels of oats, at 25 cents a bushel?
Ans. \$68,75 cents.
10. What will 560 bushels of potatoes come to, at 1s. 6d. a bushel?
Ans. \$140.

CASE SECOND.

Q. When the price is cents, and *not* an even part of a dollar, what is the *RULE*?

A. Write down the number of pounds, yards, &c. as before, and divide them by the greatest even part of a dollar, contained in the price; then take even parts of the quotient for the remainder of the price, add all the quotients together, and the sum will be the answer.

EXAMPLES.

1. What cost 137 yards of cloth, at $37\frac{1}{2}$ cents a yard?

Operation; cts.

$$\begin{array}{r} 25 \text{ is } \frac{1}{4})137 \text{ number of yards.} \\ \text{cts.} \quad \underline{\hspace{1cm}} \\ 12\frac{1}{2} \text{ is } \frac{1}{2})34,25 \text{ price, at 25 cents.} \\ \underline{\hspace{1cm}} \\ 17,12\frac{1}{2} \text{ do. at } 12\frac{1}{2} \text{ cents.} \\ \underline{\hspace{1cm}} \end{array}$$

Ans. \$51,37 $\frac{1}{2}$.

2. What must I give for 246 $\frac{1}{2}$ bushels of corn, at $87\frac{1}{2}$ cents the bushel?
Ans. \$215,68 $\frac{1}{2}$.

3. Bought 3 pieces of cloth, each $37\frac{1}{2}$ yards, at $62\frac{1}{2}$ cents a yard; what was the amount?
Ans. \$69,84,3 $\frac{1}{2}$.

4. Sold 5 chests of tea, each 62 lbs. at 65 cents a pound; what did they come to?
Ans. \$201,50.

5. What cost 97 lbs. of butter at $18\frac{1}{2}$ cents a pound?
Ans. \$18,18 $\frac{1}{2}$.

6. What cost 137 bushels of corn, at 75 cents a bushel?
Ans. \$102,75.

7. What cost 129 yds. of silk, at 68 cts. a yd.? *Ans.* \$87,72.
8. What is the amount of 4 casks of wine, each $31\frac{1}{2}$ gallons, at 85 cents a gallon? *Ans.* \$107,10.
9. Bought 467 bushels of salt, at $87\frac{1}{2}$ cents a bushel; what was the amount? *Ans.* \$408,62 $\frac{1}{2}$.
10. Sold 5 pieces of cloth, each piece containing $27\frac{1}{2}$ yds. at 65 cts. a yd.; what did the whole amount to? *Ans.* \$89,37 $\frac{1}{2}$.
11. What cost 75 yards of flannel, at 2s. 6d. the yard? *Ans.* \$31,25.

CASE THIRD.

Q. When the price of any article is given in dollars and cents, what is the RULE?

A. Write down the given quantity, as before, and multiply it by the number of dollars in the price, then take parts of a dollar for the cents, in the price, as before, and the sum of the quotients and product will be the answer.

EXAMPLES.

1. What cost 137 barrels of flour, at $7\frac{3}{4}$ dollars per barrel? *Ans.* \$1010,37 $\frac{1}{2}$.
2. What will 327 gallons of wine cost, at \$2,62 $\frac{1}{2}$ a gallon? *Ans.* \$856,37 $\frac{1}{2}$.
3. What cost 3 pieces of broadcloth, each $37\frac{1}{2}$ yards, at \$4,87 $\frac{1}{2}$ per yard? *Ans.* \$548,43 $\frac{1}{2}$.
4. What will a farm, of $375\frac{1}{2}$ acres, cost, at the rate of 14 dollars and 62 $\frac{1}{2}$ cents an acre? *Ans.* \$5491,68 $\frac{1}{2}$.
5. A butcher bought 45 sheep, at $3\frac{1}{2}$ dollars per head; what did they come to? *Ans.* \$140,62 $\frac{1}{2}$.
6. Bought 125 barrels of pork, at \$12,62 $\frac{1}{2}$ a barrel; what did they amount to? *Ans.* \$1578,12 $\frac{1}{2}$.
7. What cost 213 $\frac{1}{2}$ bushels of wheat, at $1\frac{1}{4}$ dollars a bushel? *Ans.* \$293,56 $\frac{1}{2}$.
8. What will 14 dozen pair of shoes cost, a $1\frac{1}{4}$ dollar a pair? *Ans.* 294 dolls.
9. What will 327 $\frac{1}{2}$ lbs. of indigo amount to, at \$3,65 cents a pound? *Ans.* \$1195,37 $\frac{1}{2}$.
10. Bought 4 pipes of brandy, each containing 123 gallons, at \$1,45 cents a gallon; what was the cost? *Ans.* \$713,40.
11. Sold 137 $\frac{1}{2}$ quintals of codfish, at \$3,7 $\frac{1}{2}$ a quintal; what was the whole amount? *Ans.* \$472,65,6 $\frac{1}{2}$ mills.
12. Bought 13 dozen crape shawls, at \$6,12 $\frac{1}{2}$ cents each; to what did they amount? *Ans.* \$955,50.

13. What must be given for 235 barrels of cider, at \$2.35 the barrel ? *Ans. \$552.25.*

14. Bought 175½ cords of wood, at \$4½ a cord ; what did I have to pay ? *Ans. \$866,53,1¼ mills.*

CASE FOURTH.

Q. When the quantity given consists of several denominations, as hundreds, quarters, &c. what is the RULE ?

A. Multiply the given price by the integers in the given quantity, and for the other denominations, take parts from the price of an integer : the several quotients, added together, will form the answer.

EXAMPLES.

1. What cost 7 cwt. 3 qrs. 14 lbs. of sugar, at \$9.50 per hundred weight ? *Ans. \$74.81½.*

2. What cost 12 tons, 16 cwt. 3 qrs. 21 lbs. of hemp, at \$35, 75 cents a ton ? *Ans. \$459,27½ cents.*

3. What must be given for 125 bush. 3 pks. 6 qts. of clover seed, at \$6,37½ a bushel ? *Ans. \$802,85 cts.*

4. What cost 7 yds. 3 qrs. 2 na. of lace, at \$3½ a yard ? *Ans. \$25,59 cts.*

5. A lady bought 1 yd. 3½ qrs. of satin, at 87½ cents a yard ; what did it cost ? *Ans. \$1.64 cts.*

6. What will 2 ounces of tea cost, at the rate of 92 cents the pound ? *Ans. 11,5 mills, or 11½ cts.*

7. What must you give for 4 gals. 3 qts. 1 pt. of molasses, at 33 cents a gallon ? *Ans. \$1,60,8 mills.*

8. What will 3½ qrs. of lace cost, at \$1½ a yd. ? *Ans. \$1,53.*

9. What must be given for 36 rods of land, at \$25½ an acre ? *Ans. 5 dollars, 79 cts.*

10. What must I give for 1 qr. and 3 na. of silk, at 75 cts. a yard ? *Ans. 32 cents, 8 mills.*

11. What must be given for 5 oz. of sewing silk, at 8 dollars, 25 cts. a pound ? *Ans. 2 dollars, 57 cts. 8 mills.*

12. What cost 2 qrs. 3 n. of silk, at \$1,75 a yd. ? *Ans. \$1,20.*

13. What will 24 yards, 3 quarters of broadcloth, come to, at \$5½ a yard ? *Ans. 145 dollars, 40 cts. 6 mills.*

CASE FIFTH.

Q. What are you taught by the Fifth Case ?

A. By this case, we are taught to apply the rules of Fraction, the multiplication of Compound Numbers, as of weights, measures, &c.

Q. When *one* of the terms, to be multiplied, is a whole number, and the *other*, a compound number, what is the **RULE**?

A. Multiply the whole number, given, by the integers in the compound number, and for the smaller denominations, divide the whole number by the greatest even part of an integer, contained in the smaller denominations, and for the residue, take even parts of the quotients, as in former cases, and the sum of these quotients and product will be the answer.

Q. What if all the denominations, given, in the compound number, be less than an integer; how will you then proceed?

A. As in that case, we have nothing to multiply by, we have therefore, only to divide the whole number by the greatest even part of an integer, contained in the given denominations, of the compound number, and take parts of the quotient for the residue, as before, and the sum of all the quotients will be the answer.

EXAMPLES.

1. What is the weight of 12 ingots of silver, each weighing 2 lbs. 8 oz. 12 pwts. 16 grs.?

Operation. 6 oz. is $\frac{1}{2}$ 12 ingots.
 $\times 2$ the integer.

	24
2 oz. is $\frac{1}{2}$	6
10 pwt. is $\frac{1}{4}$	2 oz.
2 pwt. is $\frac{1}{8}$	0 6 pwt.
12 grs. is $\frac{1}{4}$	0 1 4
4 grs. is $\frac{1}{8}$	0 0 6
	0 0 2

lbs. 32 7 12 Ans.

2. How many gallons in 28 kegs of wine, each containing 8 gallons, 2 qts. 1 pt. 3 gills?

Operation. 2 qts is $\frac{1}{2}$ 28 kegs.
 $\times 8$ the integer.

	224 gallons.
1 pint is $\frac{1}{2}$	14
2 gills is $\frac{1}{4}$	3 2 qts.
1 gill is $\frac{1}{8}$	1 3
	0 3 1 pt.

galls. 244 0 1 Ans.

3. How many yards in a bale of cloth, containing 48 pieces, and each piece, 31 yds. 3 qrs. 3 na. ? *Ans.* 1533 yards.

4. How many bushels of apples, in 18 barrels, each containing 2 bushels, $3\frac{1}{2}$ pecks ? *Ans.* 51 bushels, 3 pecks.

5. How many square feet in a stock of boards, 24 in number, measuring, 12 feet in length, and 1 foot $10\frac{1}{2}$ inches in width ? *Ans.* 540 feet.

6. How many solid feet, in a load of wood, measuring 8 feet in length, 3 feet in width, and 3 feet 10 inches in height ? *Ans.* 92 solid feet.

7. In 16 drums of figs, each weighing 9 lbs. 14 oz., how many pounds ? and what will they amount to at 16 cents a pound ? *Ans.* { The whole weight, 158 lbs.
Will amount to \$25.28.

8. How many acres in 6 lots of land, each containing 24 acres, 3 roods, and 35 rods ? And what must I give for the whole, at 46 dollars an acre ? *Ans.* { Whole number of acres, 149, 3 roods, 10 rods.
I must give for it, \$6891.37 $\frac{1}{2}$.

9. How many square feet, in a board 14 feet long, and 10 inches wide ? *Ans.* 11 feet, 8 inches.

10. How many gallons in 150 junk bottles, each containing 1 pint, and 3 gills. *Ans.* 32 galls. 3 quarts, 0 pint, 2 gills.

11. How many square yards in a piece of cloth measuring 36 yds. in length, and 3 qrs. 1 n. in width. *Ans.* 29 yds. 1 qr.

12. There is a strip of land measuring 36 yards in length, and $2\frac{1}{2}$ feet in width, and is so connected with my lot, that I am willing to give 50 cents the square yard; how many square yards in the strip, and what must I give for it ? *Ans.* 27 square yards. I must give for it, \$13.50.

13. How many solid feet in a load of wood measuring 4 feet in length, 1 foot, 6 inches in width, and 1 foot, 11 inches in height ? *Ans.* 11 feet, 6 inches.

CASE SIXTH.

Q. What is the Sixth Case ?

A. When two terms are to be multiplied together, both of which are Compound Numbers; as yards, feet, inches, &c.

Q. What is the RULE in this Case ?

A. Multiply *one* of the given terms, by the integers in the other given term, as in Compound Multiplication, then divide the multiplicand by the even or aliquot parts of an integer, *ained in the smaller denominations of the multiplier, as in former case, and the sum of the quotients and product will*

EXAMPLES.

1. Multiply 9 yds. 3 qrs. 2 nails, by 4 yds. 3 qrs. 3 nails.

Operation. 2 qrs. is $\frac{1}{2}$ 9 3 2
 4 yards.

	39	2	0
1 qr. is $\frac{1}{2}$	4	3	3
2 na. is $\frac{1}{2}$	2	1	$3\frac{1}{2}$
1 na. is $\frac{1}{2}$	1	0	$3\frac{1}{2}$
	0	2	$1\frac{1}{2}$

Ans. yds. 48 3 0

NOTE.—In dividing feet and inches by aliquot parts, it is most convenient to carry the remainders into seconds, (″) thirds, (″″) &c. calling 12 thirds 1 second, and 12 seconds 1 inch, and add them as in Compound Addition.

2. How many square feet in a room measuring 14 feet, 10 inches in length, and 9 feet, 9 inches wide? Ans. 144 ft. 7
- $\frac{1}{2}$
- in.

3. How many square feet in a board 13 feet, 8 inches long, and 2 feet, 7 inches wide? Ans. 35 feet, 3
- $\frac{1}{2}$
- inches.

4. How many solid feet in a stick of timber 24 feet long, 1 foot, 5 inches broad, and 10 inches in depth or thickness?

Ans. 28 $\frac{1}{2}$ feet.

5. How many solid feet of stone in a wall 40 feet, 9 inches in length, 7 feet, 10 inches in height, and 1 foot, 8 inches in thickness?

Ans. 532 solid feet.

6. How many square yards of plastering in a room measuring 16 feet, 9 inches in length, 12 feet, 8 inches in width, and 7 feet, 10 inches in height, and including the ceiling over head?

Ans. 208 yards, 2 feet, 1 inch, 8″.

NOTE.—In computing the plastering of a room, you must recollect to add the length and breadth together, and multiply their sum by 2, to get the distance round the room, then multiply this product by the height of the wall, which will give the superficial measure of the sides and ends; then if the ceiling over head is to be reckoned, cast that separately, and add its measurement to that of the walls, and the sum will be the answer.

7. How many feet of plastering in a hall 44 feet long, 24 feet, 9 inches wide, and 10 feet, 8 inches high, not including the ceiling, overhead? Ans. 1466 square feet, 8 inches.

8. How many yards in a carpet 6 yds. 2 qrs. 3 na. long, and 5 yds. 3 qrs. 2 na. wide? Ans. 39 yds. 1 qr. 0
- $\frac{1}{2}$
- na.

9. How many feet of boards will cover the sides of a building, 32 feet, 6 inches long, 22 feet, 9 inches wide, and 16 feet, 10 inches high, making no allowance for doors or windows; and how many feet will lay the floor? *Ans.* It will require 1860 feet, 1 inch, to cover the sides. 739 ft. $4\frac{1}{2}$ in. to lay the floor.

10. How many feet in a load of wood, measuring 8 feet long, 3 feet, 9 in. wide, and 3 feet, 8 in. high? *Ans.* 6 ft. $10\frac{1}{2}$ in.

NOTE.—In measuring wood on a wagon or sled, if the wood be of customary length, (that is 8 feet,) you must multiply the *average* width, by the height, and half the product will be the number of cord feet, 8 of which make a cord of wood.

NOTE 2.—If the load be more or less than 8 feet long, multiply the length and width together, and that product by the height; then divide this last product by 16, and the quotient will be the number of cord feet, as before.

11. Bought a load of wood, measuring 7 ft. 8 in. in length, 4 ft. 3 in. wide, and 5 ft. 7 in. high; how many cord feet, in the load, and what will it come to, at \$6,75 the cord.

Ans. $\left\{ \begin{array}{l} \text{It measured 11 feet, 4 in. 5", 3", 9"} \\ \text{Will come to \$9,59,2+} \end{array} \right.$

12. How many cords of wood, in a pile, 29 ft. 9 in. long, 3 ft. 10 in. wide, and 4 ft. 3 in. high; and to how much will it amount, at \$5,62 $\frac{1}{2}$ the cord?

Ans. $\left\{ \begin{array}{l} \text{It measures 3 cd. 6 ft. } 3\frac{1}{2} \text{ in. +} \\ \text{Amount, \$21,29,8 m. +} \end{array} \right.$

13. How many cubic feet, in a block of marble, 6 ft. 10 in. long, 4 ft. 7 in. wide, and 3 ft. 4 in. thick?

Ans. 104 ft. 4 in. 9" 4"

14. What quantity of wood, in a load, measuring, 8 ft. long, 2 ft. 9 in. wide, and 3 ft. 7 in. high; and what will it be worth, at 75 cents a foot?

Ans. $\left\{ \begin{array}{l} \text{It measures 9 ft. 10 in. 3"} \\ \text{Will be worth \$7,39.} \end{array} \right.$

15. How many square feet, in 32 windows, each measuring 6 ft. 4 in. in height, and 3 ft. 9 in. in width? *Ans.* 760 sq. ft.

16. What amount of duties must be paid on a piece of broad-cloth, measuring 36 yds. 3 qrs. 2 na. in length, and 1 yd. 2 qrs. 3 na. in width, at $37\frac{1}{2}$ cents the square yd.? *Ans.* \$23,33 $\frac{1}{2}$.

MISCELLANEOUS QUESTIONS.

1. What cost 123 yards of satinnet, at 5s. 6d. a yard?

Ans. 112 dollars, 75 cts.

2. What must I give for 375 barrels of beef, at $7\frac{1}{2}$ dollars a barrel?

Ans. 2765 dollars, 62 $\frac{1}{2}$ cents.

What half a pint of high wine, at \$4.50 a gallon; what?

Ans. 28 cents, 1 mill.

4. A boy in a store sold 3 gilt buttons, the price of which was 4s. 6d. a dozen, but could not tell what the 3 were worth; please to tell him. *Ans.* 18½ cents.

5. A man sold 24 acres, 3 roods, and 24 rods of land, for 45½ dollars the acre; what was the amount? *Ans.* \$1132,95.

6. A merchant bought a case of domestic shirtings, containing 14 pieces, each piece 27¼ yards, at 1s. 3d. a yard; what was the amount? *Ans.* 79 dollars, 47 cents, 9 mills.

7. What will 3 zeroons of indigo, each weighing 121 lbs. 13 oz. amount to, at \$3,45 cts. the pound? *Ans.* \$1260,75.

8. Bought 45 lbs. sugar, at 8 pence a pound; what did it come to in dollars? *Ans.* 5 dollars.

9. What cost 5 kegs of tobacco, each 73½ pounds, at the rate of 19 cents a pound? *Ans.* 69 dollars, 82½ cts.

10. What cost 1½ nails of lace, at 2 dollars, 60 cents a yard? *Ans.* 24 cts. 3 mills.

11. What cost 6 qts. of grass seed, at the rate of 3 dollars, 62½ cents a bushel? *Ans.* 67 cents, 9 mills.

12. What will a piece of silver plate come to, at the rate of 95 cents an ounce, if it weigh 32 oz. 16 pwt. 17 grains? *Ans.* 31 dollars, 19 cts. 3 mills.

13. If one pound is worth 9 dollars, what is that for 13 drams? *Ans.* 45 cents, 7 mills.

14. If a yard be worth 7 dollars, how much will half a nail cost? *Ans.* 21 cents, 8½ mills.

15. Bought a bale of English broadcloths, containing 16 pieces, each piece measuring 24 yds. 3 qrs. 2 na. in length, and 1 yd. 2 qrs. 3 na. in width, for which I am to give \$4,62½, the square yard; how many yards in the whole, and what is the amount? *Ans.* { Number of yards, 671, 2 qrs. 2 na.
Amount, \$3106,26½.

16. What will be the value of a service of silver, weighing 5 lbs. 10 oz. 12 pwts. 16 grs., being valued at \$24,75 cts. the pound, Troy? *Ans.* \$145,68½.

17. A man built a three story house, 44 ft. long, 36 ft. wide, and the sides 24 ft. high. In the lower story were 12 windows, measuring 6 ft. 6 in. in height, and 4 ft. 8 in. in width; also, 2 doors, one 8 ft. by 4 ft. 6 in., the other, 7 ft. by 3 ft. 9 in.—In the second story, were 16 windows, 5 ft. 9 in. by 4 ft. 3 in.; and in the third story, were 16 windows, 4 ft. 10 in. by 3 ft. 8 in. How many square feet in all the windows and doors? And how many feet of boards will cover the sides and ends of the house, deducting the windows and doors?

Ans. { 1100 ft. 9 in. 8" in the doors and windows.
It will require 2739 ft. 2 in. 4" of boards to cover the building.

18. How many cords of stone will build a garden wall, 150 feet in length, 5 ft. 9 in. high, and 2 ft. 8 in. thick?

Ans. 76 $\frac{3}{4}$ cords.

19. A poor woman bought a small load of wood, measuring, 6 ft. 7 in. in length, 2 ft. 5 in. wide, and 1 ft. 9 in. high; how many feet of wood, and what was it worth, at \$4.50 a cord?

Ans. { It measured, 1 ft. 8 $\frac{1}{2}$ in. +
Was worth, 97 cts. 8 $\frac{1}{2}$ m.

20. How many cubic feet in a canal, 40 miles long, 18 ft. 9 in. wide, and 6 ft. 8 in. deep; and allowing 7 galls. 1 qt. 1 pt. 3 gills of water to the cubic foot, how many gallons will fill the canal?

Ans. { Cubic feet, 26400000.
It will require 197175000 gallons.

PERCENTAGE.

Q. What is to be understood by the term *per cent*?

A. The term, *per cent*, is an abbreviation of the Latin words *per* (by) and *centum*, (the hundred,) and signifies so many hundredth parts of any number; that is, 1 per cent of any number is $\frac{1}{100}$ part of that number; 2 per cent of any number is $\frac{2}{100}$ parts of that number; 3 per cent is $\frac{3}{100}$; 4 per cent is $\frac{4}{100}$, &c.

Q. What is the RULE for finding the *per centage* of any given sum, at any given rate per cent?

A. Multiply the given sum, by the rate per cent, and divide the product by 100, or cut off the two right hand figures of dollars, and those figures at the left hand of the cut off will be the answer in dollars, and those at the right hand will be cents, &c. according to the place they occupy. If there are not two figures of dollars, in the product, you must prefix a cipher, or ciphers, to supply their deficiency.

EXAMPLES.

1. What is 6 per cent on 475 dollars?

Operation. 475
6

Ans. \$28.50 cents.

2. What is 8 per cent on 1384 dollars? *Ans.* \$110.72.

A man bought 4650 dollars of bank stock, and was to
cent of the amount, at the time of his purchase,
t must he pay down? *Ans.* \$558.

4. A merchant wishes to get his ship and cargo, valued at 25645 dollars, insured, for which he is obliged to give $2\frac{1}{2}$ per cent; what amount must he pay? *Ans.* \$641.12 $\frac{1}{2}$.

5. A broker sold a draft on England, for \$4444.44, at 12 per cent advance; what amount did he get for the draft? *Ans.* \$4977.77.

N. B.—The *amount* is the premium, or per centage, and the given sum, added together.

6. A merchant, failing in business, can pay only $37\frac{1}{2}$ per cent of the amount of his debts; what amount must I receive for a demand against him, of 1346 dollars, and 50 cents? *Ans.* \$505.93 $\frac{1}{2}$.

7. A man bought 875 dollars, and 67 cents worth of goods, and is allowed 4 per cent discount, for prompt pay; what amount must he pay for his goods, after deducting the discount? *Ans.* \$840.643 mills.

8. A manufacturing company find it necessary to assess a tax on their capital stock, of 8 per cent; what must that man pay, who owns 8750 dollars of the stock? *Ans.* \$700.

9. What will 9 per cent on 25 dollars be? *Ans.* \$2.25.

10. A man bought an article for 12 dollars, and wishes to sell it, at $12\frac{1}{2}$ per cent advance; what price must he get for it? *Ans.* \$13.50.

11. What is 1 per cent on 9 dollars? *Ans.* \$0.09 cts.

12. What is 3 per cent on 12 dollars?

13. What is 3 per cent on 25 cents?

14. What is 4 per cent on 75 cents?

15. What is 9 per cent on \$20.50?

16. What is 5 per cent on \$35.75?

17. If a man, whose property is worth 75000 dollars, be taxed $\frac{1}{2}$ of 1 per cent, what amount must he pay? *Ans.* 375 dollars.

18. A man bought 75 bank shares, at 100 dollars the share, and sold them at 9 per cent advance; how much did he make by his speculation? *Ans.* 675 dollars.

INTEREST.

Q. What is Interest?

A. It is a compensation, paid by the person money, to the person who loans it, for the use of

Q. In what way is interest reckoned on me

A. At so much per cent per annum; that the use of 100 dollars, for one year.

L*

Q. What do you understand by legal, or lawful interest?

A. Lawful interest is that rate of interest, which is established by law, in any State.

Q. What rate is established by law, in the New-England States?

A. Six per cent per annum; that is, six dollars for the use of 100 dollars, for one year.

Q. How many parts or terms are to be noticed in interest?

A. Three; viz: the principal, the rate, and amount.

Q. How are these parts or terms distinguished?

A. The *principal* is the sum lent; the *rate* is the sum per cent allowed for the use of 100 dollars; the *amount* is the principal and interest, added together.

Q. How many kinds of interest are there?

A. Two; Simple and Compound.

SIMPLE INTEREST.

Q. What is Simple Interest?

A. It is when the interest is cast on the principal alone, for any length of time.

Q. When the interest of any sum is required for one year only, what is the RULE?

A. Multiply the principal by the rate per cent, and divide the product by 100, or cut off the two right hand figures of dollars, and the quotient, or the figures at the left hand of the *cut off*, will be the answer in dollars, and those at the right hand will be cents and mills, according to the place they stand in from the *cut off*. If there is but one place or figure of dollars, a cipher must be placed at the left hand of that figure, which will make the two figures to be cut off.

EXAMPLES.

1. What is the interest of 150 dollars, for one year, at 6 per cent.?

Operation. 150 principal.
6 rate per cent.

Ans. 9,00 dollars.

2. What must be given for the use of \$46,50, for one year, at 6 per cent?

Ans. \$2,79 cents.

3. If I lend my friend \$329,75, for 1 year, at 6 per cent, what sum must he pay me back at the year's end?

Ans. \$349,53½ cts.

will be the interest on \$14,75 cents, for one year,
1?

5. What is the amount of \$247,34, for one year, at 5 per cent?

Operation.
$$\begin{array}{r} 247,34 \\ 5 \end{array}$$

$$\begin{array}{r} 12,3670 \text{ interest on the sum.} \\ 247,34 \text{ principal to be added.} \end{array}$$

Ans. \$259,70,7 mills, amount.

6. A man bought a farm for \$2746, and agreed to pay for it in one year, and allow interest at 7 per cent until the time of payment; what was the interest due, and what was the amount?

Ans. $\left\{ \begin{array}{l} \text{Interest, \$192,22 cents.} \\ \text{Amount, \$2938,22 cents.} \end{array} \right.$

7. What will be the interest on \$24,75 cents, for one year, at 6 per cent?

8. A farmer sold a cow for 27 dollars, on one year's credit, with interest, at 6 per cent; what amount must he receive at the end of the year?

9. A person owes me \$560, which will be due in one year, and offers to pay it now if I will deduct the legal interest, which I agree to do; how much must I receive? *Ans.* \$526,40.

10. What amount must be paid for a note of \$13,85 cts. on which one year's interest has arisen?

11. A gentleman owning a span of elegant horses, is offered for them \$450 in cash, or \$500 payable in one year, without interest; which offer is best, and by how much, valuing money at 6 per cent?

12. Which had you rather have, 950 dollars in cash now or 1000 dollars paid in one year from this time, reckoning money at 6 per cent?

CASE SECOND.

- Q. When the interest of any sum is required for more years than one, or for parts of a year, as months and days, what is the RULE?

A. First find the interest of the given sum for one year, as before; then multiply this interest by the number of years, which will give the interest for *that* time; then if there be parts of a year, as months and days, work for the months, by taking aliquot parts of a year, and for the days by taking aliquot parts of a month, allowing 30 days to the month, the sum of the several quotients and product, will be the *ans*

Q. How do you find the time, from the date of any the period of settlement?

A. Write down the year in which the note is settled, then count the months from January of that year, to the *month* in which it is paid or settled, and write the number of months, thus found, at the right hand of the year; then count the number of days, from the first day of the month to the *day* on which it is settled, and place them at the right hand of the months, making the year, months, and days, a minuend, under which write, as in compound subtraction, the year, months, and days, found as before, on which the note is dated, as a subtrahend; then subtract, and the remainder will show you the time.

Q. Upon what principle of arithmetic are these rules, for casting interest, founded?

A. Upon the Rule of Three Direct, or the principle of proportion.

Q. How is the Rule of Three applicable to these rules for casting interest?

A. The operation of these rules is precisely the same as by stating the question, and saying, as 100 : is to the rate per cent :: so is the given sum : to the interest.

EXAMPLES.

1. What will be the interest of 237 dollars, for 3 years, at 6 per cent?

Operation. $\begin{array}{r} 237 \\ 6 \end{array}$

$\begin{array}{r} 14,22 \\ 3 \end{array}$ one year's interest.

Ans. \$42,66 three year's interest.

2. What will be the interest of \$127,45 cents, for 4 years, 7 months, and 15 days, at 6 per cent?

Operation. $\begin{array}{r} 127,45 \\ 6 \end{array}$

Six months is $\frac{1}{2}$ of one year. $\frac{1}{2}$ 7,64,70 Interest for one year.
4 Number of years.

$\begin{array}{r} 30,58,80 \\ 3,82,35 \\ 0,63,72 \\ 31,86 \end{array}$ Interest for 4 years.
One month is $\frac{1}{6}$ of 6 months. $\frac{1}{6}$ 3,82,35
 $\frac{1}{2}$ of one month. $\frac{1}{2}$ 0,63,72

Ans. \$35,36,73

3. What will be the interest of \$184.62 cents, for 2 years, 4½ months, at 6 per cent? *Ans.* 26 dollars, 30 cents.

4. What will a note of 375 dollars, and 50 cents, amount to in 4 years, 8 months, and 20 days, at 6 per cent per annum? *Ans.* 481 dollars, 89 cents.

5. A farmer sold a span of fine horses, for \$275.46, but was unable to get his pay until 3 years, 5 months, and 25 days after he sold them; what amount ought he to receive, reckoning interest at 7 per cent? *Ans.* \$342,679 mills.

6. On the 15th of April, I lent my friend 450 dollars, and took his note on demand, with interest, but did not get my money until the 1st of November, following; what amount must I have received at that time? *Ans.* \$464,62½.

7. A gentleman sold his farm for \$2431,87, and took a note on demand, with interest until paid; the note was dated October 25th, 1830, but was not paid until May 10th, 1831; what was the interest, and what the amount which the gentleman must receive for his demand?

Ans. { Interest, \$79,03½ cents.
Amount, \$2510,90 cents.

8. If a note for \$25,75, be dated July 1st, 1828, and paid Dec. 16th, 1830, what was the amount at the time of settlement, reckoning interest at 5½ per cent? *Ans.* \$29,23 cents.

9. What will be the interest of 9 dollars, 35 cts., for 5 years, 10 months, and 25 days, at 6½ per cent? *Ans.* \$3,45 cents.

10. A note, dated June 25th, 1818, for 137 dollars, 50 cents, was paid March 10th, 1825; what amount was then due, with interest at 6 per cent? *Ans.* 192,84 cents.

11. A merchant sold to his customer, goods to the amount of \$468,75, on a credit of 6 months, and took a note for the same, dated April 13th, 1822; but the note was not paid until August 26th, 1827; can you tell how much interest was due on the note, and what amount the merchant received for his demand?

Ans. Interest, \$136,95. Amount, \$605,70 cents.

12. If a note of \$62½, fall due June 1st, 1829, and is not paid till Feb. 21st, 1830, how much interest must be paid upon it, supposing money to be worth 7½ per cent? *Ans.* \$3,27.

13. What will a note of \$13,89 cents, amount to, in 2 years, 9½ months, at 6 per cent? *Ans.* \$16,21 cents.

14. I owe to my friend 250 dollars, which will not become due till 9 months from this time; but he offers if I will pay him now, to deduct 8 per cent interest; what sum must I pay him, if I agree to his condition? *Ans.* \$235.

15. I own a note of \$1347,80, due in 4 months, and but am willing to deduct 7 per cent interest, if I can *money now; how much must I deduct?* *Ans.*

CASE THIRD.

Q. What short practical rule have you for casting the interest on any sum for any number of months?

A. If the rate be six per cent, multiply the principal by half the number of months, and cut off the two right hand figures of *dollars* from the product, and you will have the answer, as in the foregoing cases.

Q. If the rate be more or less than 6 per cent, how can you apply this rule?

A. Multiply the principal by the same *proportion* of the given number of months, as the *rate per cent* bears to 12, and you will have the true interest as before.

EXAMPLES.

1. What is the interest of 145 dollars, for 8 months, at 6 per cent?

$$\begin{array}{r} \text{Operation.} \quad 145 \\ 8 \div 2 = \quad 4 \end{array}$$

Ans. \$5.80.

2. What is the interest of 150 dollars, for 18 months, at 8 per cent per annum?

As 8 is $\frac{2}{3}$ of 12, you must multiply the principal by $\frac{2}{3}$ of 18 months = 12 months.

$$\begin{array}{r} \text{Operation.} \quad 150 \\ 12 \end{array}$$

Ans. \$18.00.

3. What is the interest of \$249.50, for 9 months, at 6 per cent?

Ans. \$11.22 $\frac{1}{2}$.

4. What will \$246.50 amount to in 24 months, at 9 per cent?

Ans. \$290.87.

5. What will \$19.37 $\frac{1}{2}$ amount to in 10 months, at 6 per cent?

Ans. \$20.34.

6. What is the amount of \$37.25, for 14 months, at 6 per cent?

Ans. \$39.85 $\frac{1}{2}$.

7. Find the interest of \$95, for 6 months, at 4 per cent.

Ans. \$1.90.

8. What will be the interest of \$9.25, for 7 months, at 6 per cent?

Ans. \$0.32, 3 mills.

9. What is the amount of \$13.45, for 3 months, at 6 per cent?

Ans. \$13.65.

If I lend my friend \$75, for 8 months, at 9 per cent, must he pay me, principal and interest? *Ans.* \$79.50.
 How much money can be had for 4 per cent, what interest
 y for 362 dollars, for 9 months? *Ans.* \$10.86.

12. I hold a note of Benjamin Goodpay, for 735 dollars, payable in 9 months; being in want of money, I get it discounted at a bank, by deducting the interest at 6 per cent; how much money must I receive? *Ans.* \$701,92½.

13. What must be paid for the use of \$1237,80, for 23 months, at 6 per cent? *Ans.* \$142,347 mills.

14. What will be the interest of \$262½, for 8½ months, at 6 per cent? *Ans.* \$11,156 mills.

15. What must be paid for a note of \$37,50, for 2 years, 6 months, and 15 days, at 6 per cent a year. *Ans.* \$43,21,8 m.

16. I lent a merchant \$225, and 4 months afterwards I lent him \$350 more; 4 months from the last loan, he paid me in part \$425, and 4 months after that, he paid me the balance; how much interest was due on the whole, and what amount did I receive for my debt? *Ans.* Interest \$19. Amount \$594.

17. Borrowed of A. \$335, and 6 months afterwards borrowed twice as much more; in 6 months after that I paid the whole, allowing 6 per cent interest; what was the interest, and what the amount paid? *Ans.* Interest \$40,20. Amount \$1045,20.

CASE FOURTH.

Q. What short and convenient rule have you for finding the interest of any sum for any number of days?

A. If the rate be 6 per cent, multiply the principal by the given number of days, and divide the product by 60, and then cut off the two right hand figures of dollars, and those at the left hand will be the answer in dollars, and those at the right hand will be cents, mills, &c. If there is but one place or figure of dollars, a cipher must be placed at the left hand of that figure, which will make the two figures to be cut off.

Q. How may the operation be shortened?

A. By multiplying by any even part of the number of days, as ½, ⅓, ¼, &c. and dividing by the same even part of 60, and pointing off the figures as before.

Q. Can this rule be applied to any rate of more or less than 6 per cent?

A. It can, by finding and using a divisor, proportioned to the rate per cent?

Q. How can you find a divisor for any rate per cent?

A. Divide 365 days by any rate per cent, and the quotient will be a divisor for that rate.

NOTE.—Although the above rules are sufficiently near the truth for common use, if the sum be large, and great ~~ness~~ necessary, the true divisor is found by multiplying 100, and dividing the product by the rate per cent,

ceeding as before. This rule is founded on the fact, that 365, multiplied by 100, and divided by any rate per cent, will show the number of days in which any sum will double at such rate of interest.

EXAMPLES.

1. What is the interest on \$125,35 cents, for 25 days, at 6 per cent a year? Operation. cts. m.

$$125,35 \times 25 \div 60 = \$0,52,2\frac{2}{3}$$

I then cut off the two right hand figures of dollars, and the result is 52,2 mills, which is the answer.

2. What is the interest on \$236,46 cents, for 33 days, at 6 per cent? *Ans.* \$1,30 cents.

3. What will 187 dollars amount to, in 63 days, at 6 per cent? *Ans.* \$188,96 cents.

4. What must be paid for the use of 450 dollars, for 93 days, at 8 per cent? *Ans.* \$9,30 cents.

5. What will \$13,75 amount to, in 20 days, at 6 per cent per annum? *Ans.* \$13,79,5 $\frac{8}{10}$ mills.

6. I hold a note against Mr. Punctual, for 93 dollars, 46 cents, payable in 80 days, which he offers to pay now, if I will deduct 5 per cent interest; how much must I receive for the note? *Ans.* \$92,43,6 mills.

7. How much must a bank deduct for discounting a note of 7500 dollars, for 120 days, interest at 6 per cent? *Ans.* \$150.

8. What is the interest on \$9,50 cents, for 10 days, at 6 per cent. *Ans.* 1 cent, 5 $\frac{9}{10}$ mills.

CASE FIFTH.

Q. When it is required to calculate interest on cash accounts, accounts current, or on any other accounts where partial payments are made, or partial debts contracted, what is the Rule?

A. Multiply the several balances by the number of days they have drawn interest, then add all these products together, and divide their sum as before, by that divisor, which the rate per cent requires, and you will have the interest which is due on the account.

EXAMPLES.

1. On the 1st of January I lent 450 dollars, which I received back in the following partial payments, viz.: on the 14th of January, 57 dollars; on the 7th of February, 40 dollars; on the March, 65 dollars; on the 4th of April, 45 dollars; on

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the 26th of April, 20 dollars; on the 12th of May, 100 dollars; on the 10th of June, 60 dollars; and on the 1st of August, I received the balance, which was 63 dollars; what interest was due me, at 6 per cent?

January 1, Lent on demand, $450 \times 13 = 5850$

" 14, Received in part, 57

Balance, $393 \times 24 = 9432$

February 7, Received in part, 40

Balance, $353 \times 40 = 14120$

March 19, Received in part, 65

Balance, $288 \times 16 = 4608$

April 4, Received in part, 45

Balance, $243 \times 22 = 5346$

" 26, Received in part, 20

Balance, $223 \times 16 = 3568$

May 12, Received in part, 100

Balance, $123 \times 29 = 3567$

June 10, Received in part, 60

Balance, $63 \times 52 = 3276$

August 1, Rec'd the balance, 63 $49767 \div 60 = \$8,29.$

NOTE.—When the sum is large, dividing the amount of the products by 61, in place of 60, approaches a little nearer the truth; dividing the preceding sum by the exact divisor, 60,83, gives \$8,18 cents for interest; dividing by 61, gives \$8,15 cts.; therefore, taking 61 as divisor, when the rate is 6 per cent, the result will be near enough in all cases.

2. Compute the interest at 6 per cent, on the following account, to August 10th, 1829.

Dr. Mr. A. B. in account current with C. D. Cr.

1829.	To Cash	\$	cts.	1829.	By Cash	\$	cts.
January 1	" "	560		March 10	" "	120	
February 10	" "	300		April 25	" "	130	
May 15	" "	140		June 16	" "	450	
July 25	" "	100		July 21	" "	15	

Ans. Sum of the products, $131820 \div 61 = \$21,61$ cts.

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SIMPLE INTEREST.

3. I gave a young man, who served his clerkship with me, on his commencing business, a cash credit of 1000 dollars; in consequence of which, on the 12th of May, I paid his bill on me for 250 dollars; on the 27th of May, I paid his draft for 280 dollars; June 1st, he gave me a check on the Branch Bank, for 290 dollars; July 17th, he paid me, per receipt, 70 dollars; August 20th, he drew a bill on me for 750 dollars, which I paid; and on the 31st of August, he paid me 500 dollars; September 15th, he drew on me at sight for 135 dollars; on the 3d of October, he drew for 175 dollars more; October 29th, he paid me, per receipt, 250 dollars; and November 3d, 125 dollars more; November 12th, he drew for 375 dollars; and on the 18th, for 125 dollars more; January 1st, he paid me, per receipt, 290 dollars, and on the 20th, 210 dollars more; the 1st of March, following, he asked a settlement; what was then due me, allowing interest at 6 per cent?

Balance due on the account, \$355.00

Sum of the products, $141140 \div 61 = \$23,14$ interest.

Ans. \$378.14.

4. A commission merchant having sold sundry goods for his correspondent, made out the following account current, on which interest is to be computed on the several amounts, according to the conditions of sale, and also on the different sums paid, according to the terms of payment.

Dr. Mr. B. C. of New-York, in account with A. B. Cr.

Dates.	How paid.	Credits	Amounts.	Dates.	Articles sold.	Credits	Amounts.
1829		days.	\$	1829		days.	\$
Feb. 1	Acceptance	60	350	Jan. 14	Silks	60	140
" 25	Cash		275	" 30	Broadcloths	90	225
Mar. 15	Draft	90	500	Feb. 14	Wines	60	175
May 20	Draft	60	350	April 15	Sugars	120	325
July 25	Cash		400	June 1	Cassimeres	90	112
Aug. 25	Draft	90	500	" 16	Shirting	60	93
				" 30	"	60	125
				July 4	Wines	4 mo	575
				" 20	"		90 380
				Aug. 1	Silks	3 mo	290
				" 25	Broadcloths	90	365

What remains due on the 23d day of November, (the time at which the last sale falls due,) computing interest at 6 per cent?

Balance on amount of sales, without interest, \$435.00

Balance of int deducted, \$19.03

Ans. \$415.97

5. Suppose a bill of \$350 was due January 1st, 1830, and on the 3d of February, 75 dollars were paid; March 5th, \$50 more were paid; April 9th, \$80; June 7th, \$145; what interest is due at 5 per cent? What at 6? What at 7?

Ans. At 5 per cent, \$4.96. At 6, \$5.92. At 7, \$6.96.

CASE SIXTH.

Q. How will you compute the interest on any note or obligation, on which partial payments or endorsements have been made at different times?

A. Find the amount of the whole principal from the date of the note to the time of settlement: then find the amount of each endorsement, separately, from the time of its payment to the time of the payment of the note: then add all the amounts of the several payments together, and subtract their sum from the amount of the whole note, and the remainder will be the sum which still remains due on the note.

N. B. Different rules have been established by the Courts of different states, for casting interest on partial payments, but the above rule, although not *exactly* correct, is, on account of its simplicity and conciseness, most generally used, and is sufficiently near the truth to answer all common purposes.

EXAMPLES.

1. On the 17th of April, 1823, I gave my note for 675 dollars, with interest at 6 per cent per annum, on which I made partial payments, as follows: May 7th, 1824, I paid \$148; August 17th, 1826, \$341; January 2d, 1828, \$99; I wish to know how much remains unpaid and due on the note, June 17th, 1828?

Ans. 219 dollars, 52 cents.

2. A note, dated January 1st, 1828, was given for 1000 dollars, drawing interest at 6 per cent, on which the following partial payments were made, viz.: March 1st, 1829, paid 75 dollars; July 1st, 1829, 20 dollars; September 1st, 1830, 20 dollars; November 1st, 1830, 750 dollars; March 1st, 1831, 100 dollars; what is the balance due, July 1st, 1831?

Ans. 199 dollars, 10 cents.

3. On the 16th of January, 1825, I gave my note for 500 dollars on demand, with interest at 6 per cent, on which I made the following endorsements, viz.: April 1st, 1826, 50 dollars; July 16th, 1827, 400 dollars; September 1st, 1828, 6 dollars; what was due on the note, principal and interest the 16th of November, 1830?

Ans. 63 dollars, 18 cen

4. On the 1st of April, 1824, I sold a farm for 7500 dollars, and took a note for the amount, payable in 18 months, without interest till it became due, after which, I was to be allowed interest at 6 per cent till paid; it was farther agreed that any payments in part, before the note became due, should draw interest from the time of payment; partial payments were therefore made as follows, viz.: received July 15th, 1824, 450 dollars; November 1st, 1824, 350 dollars; February 15th, 1825, 180 dollars; October 1st, 1825, 4500 dollars; March 15th, 1826, 1250 dollars; on the 20th of December, following, I received the balance; what was then due, principal and interest?

Ans. \$801, 77 cents, 7 mills.

¶ The following RULE, which is nearly or quite as plain as the one already given, will in general approach nearer the truth, particularly in large sums, when a number of endorsements have been made; and will be found to vary but in a slight degree, from the rules established by the Courts of Massachusetts, Connecticut, and New-York, and on account of its being more easily understood by the scholar, I have given it, in preference to either.

RULE SECOND.

Compute the interest on the whole note, to the time of the first endorsement, and find the amount, from which subtract this first endorsement; then find the amount of this balance up to the time of the second endorsement, from which amount subtract this endorsement as before, and thus continue to compute from one endorsement to another, subtracting each one as you proceed, until all the payments are taken out; then find the amount of the last balance up to the time of settlement, and you have the correct answer.

EXAMPLES.

1. On the 1st of January, 1825, Peter Payment owed me 875 dollars, on which I was to receive interest at 7 per cent; on the 1st of June, he paid me 125 dollars; January 1st, 1826, he paid 190 dollars; July 1st, 175 dollars; December 1st, \$110; April 1st, 1827, he paid \$250; and on the 1st of October, handed me the balance; what was the amount due by each of the preceding Rules, and what amount of interest was paid, by each rule; also, what is the difference of amount by the two rules?

Ans. {	Amount due by Rule 1st,	119 dollars	26 cts.
	" " Rule 2d,	130 "	25 "
	Interest by Rule 1st,	94 "	26 "
	" Rule 2d,	105 "	25 "
	Difference of amount,	10 "	89 "

2. A note was given on demand for \$435.50, dated June 10th, 1828, on which the following partial payments were made, viz.: September 1st, 1828, 84 dollars, 75 cents; December 16th, 1828, 110 dollars, 50 cents; February 24th, 1829, 184 dollars, 25 cents; and on the 26th of May following, the note was settled; what was the amount then due, with interest at 6 per cent?

Ans. \$72.06 cents, 6 mills.

3. Ninety days after date, I promise to pay A. B. or order, five hundred and ninety-six dollars, and eighty cents. Value received.

J. WORTHY.

PROVIDENCE, August 21st, 1829.

On the above note were the following endorsements, viz.: December 10th, 1829, 136 dollars, 50 cents; February 15th, 1830, 127 dollars, 80 cents; May 30th, 1830, 240 dollars, 70 cents; and on the 4th of July following, the note was settled; what was the balance then due? *Ans.* 105 dollars, 43 cts.

4. A note was given January 1st, 1825, for \$1000, on demand, with interest at 6 per cent, on which were the following endorsements, viz.: March 1st, 1826, 75 dollars; July 1st, 1826, 20 dollars; September 1st, 1827, 20 dollars; November 1st, 1827, 750 dollars; March 1st, 1828, 100 dollars; what was the balance due on the 1st of July, 1828? *Ans.* \$215.30.

5. I gave my note, dated January 1st, 1828, for \$1000, with interest at 6 per cent, on which partial payments were made as follows, viz.: April 1st, 1829, paid 200 dollars; January 1st, 1830, \$100; June 1st, 1831, \$300; September 1st, 1831, \$400; on the 1st of October, following, the note was settled; what amount was then due on my note? *Ans.* \$193.31.

COMPOUND INTEREST.

Q. What is meant by Compound Interest?

A. Interest is called Compound, when the interest of one year is added to the principal, and that amount made the principal for the second year, and so on for any number of years.

Q. How do you find the compound interest of any sum for any number of years?

A. Find the interest for one year, and add it to the principal, and call it the amount for the first year; find the interest of this amount, which add as before, for the amount of the second year, and so on for any number of years.

Q. How is compound interest computed on a note odd months and days have accrued?

A. Find the interest for the number of years as find the interest of this last amount for one year take aliquot parts of this last year's interest for.

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days, as in simple interest ; then in both cases, if the interest alone is required, subtract the original principal from the last amount, and the difference will show the interest.

EXAMPLES.

1. What is the amount of 100 dollars, for three years, at 6 per cent, compound interest ?

Operation.	100	
	6	
	6,00	
	100	
	106,00	Amount for first year.
	6	
	6,3600	
	106	
	112,36,00	Amount for second year.
	6	
	6,74,1600	
	112,36	

Ans. \$119,10,16,00 Amount for third year.

2. What is the compound interest of \$740, for 6 years, at 4 per cent per annum ? *Ans.* \$196, 33 cents, 6 mills.

3. What will be the compound interest of \$500 for 1 year, at 2 per cent a month ? *Ans.* \$134, 12 cents, 1 mill.

4. What will be the amount of a note, dated June 15th 1826, for \$375,80, which is settled August 30th, 1830, reckoning compound interest, at 6 per cent ? *Ans.* \$480,37.

5. A note was given for \$1240, dated January 1st, 1825, and partial payments were made as follows, viz.: August 15th, 1827, paid \$250 ; April 25th, 1829, paid \$450 ; November 30th, 1831, the balance was paid ; what interest had accrued on the note, and what amount was then due, computing compound interest, at 6 per cent ?

Ans. Interest, \$472,31 ; amount \$1012,31.

6. If I let a house for $4\frac{1}{2}$ years, at \$375 a year, and do not receive until the expiration of the whole term, what I receive then, reckoning compound interest on it, as it becomes due, at 6 per cent ?

Ans. \$1877,19.

7. A bond was given for 10,000 dollars, to be paid in equal payments of 1000 dollars yearly, and continue till the principal and interest were absorbed in the payments; now I wish to know how many years it will require to pay off the principal and interest, how much interest will accrue on the whole, and what the last balance will be, compound interest, at 6 per cent, allowing the last balance to run to the end of the year, after the last annual payment of 1000 dollars?

Ans. $\left\{ \begin{array}{l} 16 \text{ years will be requisite.} \\ \text{Whole amount of interest, \$5730,98 cts. 9 m.} \\ \text{Last balance, \$730,98 cts. 9 m.} \end{array} \right.$

DISCOUNT.

Q. What is Discount?

A. It is an allowance made for the payment of any sum of money before it becomes due, or for advancing ready money for notes, bills of exchange, &c. which are payable at a future day.

Q. What is the present worth of any sum?

A. It is what is left, after the discount is deducted, and is such a sum, as, if put to interest for the given rate and time, would amount to the original sum or debt.

Q. What is the RULE for finding the discount of any sum, for any given time?

A. First, find the amount of \$100, for the given rate and time, at simple interest; then say, as this amount of 100 dollars: is to the interest of 100 dollars:: so is the given sum: to the discount: Subtract this discount from the given sum, and the remainder will be the present worth.

Q. How will you state the question, to find the present worth, in the first instance?

A. Find the amount of 100 dollars as before; then say, as this amount of 100 dollars: is to 100 dollars:: so is the given sum: to the present worth.

¶ The above RULE for making discounts, though strictly correct, is now, by common consent, entirely out of practice with merchants and bankers throughout the United States; a few questions will therefore be given under this rule, that the scholar may not be ignorant of the true arithmetical *making discount*. Others will be given under *Mer Bankers Rule*, as more conformable to practical b

DISCOUNT.

EXAMPLES.

1. What must be discounted for the ready payment of 150 dollars, due one year from this time, discounting 6 per cent?
Operation. 100 dollars.

$$\begin{array}{r} 6 \\ \hline 6,00 \\ 100 \end{array}$$

Amount of \$100 = 106 : 6 :: 150 : \$8,49 *Ans.*

2. What is the discount on 2119 dollars, 50 cents, due 2 years hence, at 5½ per cent per annum? *Ans.* \$210,04.

3. What is the present worth of 700 dollars, payable in six months, discounting 6 per cent per annum? *Ans.* \$679,61.

4. What must be discounted for the ready payment of 797 dollars, 50 cents, payable in 5 months, and 20 days, discounting 6 per cent per annum? *Ans.* 21 dollars, 94 cents.

5. Bought a quantity of goods, amounting to 500 dollars, ready money, and sold them for 600 dollars, on 9 months credit; what was my actual gain, reckoning discount at 6 per cent? *Ans.* 74 dollars, 16 cents, 2 mills.

6. What is the present worth of \$216,66, due 15 months hence, discounting 6 per cent? *Ans.* 201 dollars, 55 cts.

7. What will be the discount of 1205 dollars, 92 cents, payable in one year, discounting 6 per cent? *Ans.* \$68,25.

MERCHANTS AND BANKERS RULE.

- Q. By what RULE do merchants and bankers make their discounts?

A. By finding the interest of the given sum, from the time of discounting it, to the time when the note, bill, or sum will become due, and this interest they call the discount; subtract the interest from the given sum, and the remainder will be the present worth.

EXAMPLES.

1. What is the discount of 250 dollars, for 30 days, at 6 per cent? Operation. $\$250 \times 30 \text{ days} \div 60 = \text{Ans. } \$1,25.$

2. An auctioneer sold goods for his consignor, to the amount of \$4758, payable ½ in 2 months, ½ in 3 months, and ½ in 4 months; but wishing to settle accounts, he agrees to pay ready for the amount, on discounting 6 per cent per annum; how much must he pay? *Ans.* \$4686,63.

3. What discount must I receive, for the ready payment of a bill of exchange, drawn on me at 60 days, for 560 dollars, at 7 per cent discount? *Ans.* \$6,46 $\frac{1}{2}$ cents.

4. If a merchant sell goods to the amount of \$734,50, on 4 months credit, what allowance must he make to the purchaser, for the ready payment of the same, discounting 6 per cent? *Ans.* \$14,69 cents.

5. I held a note, dated April 1st, 1831, for 375 dollars, 75 cents, payable in 90 days from the date. On the 15th of June, I got it discounted at Bank, at 6 per cent; what amount did I receive? *Ans.* \$374,81.

6. A merchant drew a bill of exchange, on his agent in New-York, for \$11540, at 33 days, and got it discounted at bank, at 6 per cent per annum, allowing, also, $\frac{1}{4}$ per cent on the whole amount, for brokerage, besides the interest; what was the whole discount, and what amount did the merchant receive? *Ans.* Whole discount, \$92,32. Amount, \$11447,68.

7. A gentleman sold his farm for 15750 dollars, payable in 4 equal payments, viz.: one fourth in 6 months, one fourth in 9 months, one fourth in 12 months, and one fourth in 15 months; but being in want of the money, the purchaser agreed to pay the whole, at the expiration of the first payment, by deducting the interest at 6 per cent; what amount did the gentleman receive for his farm? *Ans.* \$15395,62 $\frac{1}{4}$.

8. A man sold a farm, containing 325 acres, at \$14 $\frac{1}{2}$ an acre, on 2 years credit; how much ready money will pay for it, deducting 5 $\frac{1}{2}$ per cent per annum? *Ans.* \$4194,12 $\frac{1}{2}$.

9. A merchant bought goods to the amount of 4500 dollars, on 9 months credit; but being in great want of money at the time, he sold the whole for cash, and deducted 2 $\frac{1}{2}$ per cent from the purchase price; did he gain or lose by the speculation, and how much, allowing money to be worth 7 per cent? *Ans.* He gained 117 dollars, 84 cts.

10. What must be discounted for the ready payment of a draft, for 1347 dollars, at 93 days, deducting interest at 7 per cent? *Ans.* 24 dollars, 09 cts.

11. A merchant holds three notes against his customer, viz.: one, dated March 5th, 1831, for 500 dollars, payable in 6 months from the date; the second, dated April 11th, 1831, for 475 dollars, payable in 120 days from the date; the third, dated June 15th, 1831, payable in 5 months, for 687 dollars; on the 25th of July, he gets them discounted at 6 per cent; what is the discount and what is the neat amount received?

Ans. { Amount discounted, 17 1
 { Amount received, 1644

12. A merchant accepted a draft from his agent, for \$7350, payable at 60 days sight; but the holder of the draft, wishing the money down, agrees to discount the interest at 8 per cent; what is the discount, and how much ready money does he receive for the draft? *Ans.* Discount, \$98. Amount, \$7252.

COMMISSION.

Q. What is to be understood by Commission, Factorage, and Brokerage?

A. They are premiums, at so much per cent, allowed to persons, called correspondents, factors, or brokers, for assisting merchants and others, in buying and selling goods, bills of exchange, or exchanging money.

Q. What is the RULE for finding the commission, factorage, or brokerage on any given amount?

A. Multiply the given sum by the rate per cent allowed, and cut off the two right hand figures of dollars, as in Simple Interest, and the figures, at the left hand of the cut off, will be the answer in dollars, and those at the right, will be cents, and mills.

EXAMPLES.

1. What is my commission on the purchase of goods, the invoice of which amounts to 1740 dollars, at $2\frac{1}{2}$ per cent?

Operation. 1740
 $2\frac{1}{2}$

 3480
 870
 435

\$47,85 *Ans.*

2. A commission merchant sold for his correspondent, goods to the amount of 48,450 dollars, on which he was allowed $2\frac{1}{2}$ per cent; what was his commission, and what was the neat amount of sales?

Ans. { Commission \$1090,12 $\frac{1}{2}$.
 Neat amount of sales \$47359,87 $\frac{1}{2}$.

3. A broker sold, for his correspondent, a bill on England for £1000 sterling, equal to \$4444,44 cents, for which he is 2 $\frac{1}{2}$ per cent; what is his commission? *Ans.* \$22,22 $\frac{1}{2}$.

What is the amount of \$750, and am allowed 2 $\frac{1}{2}$ per cent of my commission? *Ans.* \$17,50.

INSURANCE.

Q. What is Insurance ?

A. It is an allowance of so much per cent, paid to persons, offices, and insurance companies, for an engagement to make good the loss of ships, merchandize, houses, stores, furniture, &c. that may happen from storms, or from the depredations of enemies and pirates at sea, or from destruction by fire.

Q. What is meant by "Underwriters ?"

A. They are the persons who are bound to make good the loss, if any is sustained.

Q. What is the Principal ?

A. It is the amount insured.

Q. What is the Premium ?

A. It is the sum paid to the underwriters, for their engagement to make good the loss.

Q. What is the Policy ?

A. It is the document or writing, that contains the agreement between the parties.

Q. What is meant by Particular average ?

A. It is dividing, equally, among the several owners of the goods on board a vessel, any loss, that may arise from ordinary circumstances, according to their several interests in the goods insured.

Q. What is meant by General average ?

A. It is the proportion to be paid by all the owners, both of ship and cargo, for any losses, necessary to preserve the rest ; such as cutting away masts, throwing goods overboard, &c. and is to be equally apportioned among them, according to the amount of property owned by each.

CASE FIRST.

Q. What is the RULE for finding the premium on any amount insured ?

A. By the same rule that you find the interest of the same sum, for one year, at the given rate per cent.

EXAMPLES.

1. What premium must be given for the insurance of a ship and cargo, valued at 15,475 dollars, at $2\frac{1}{2}$ per cent ?

Operation $15475 \times 2\frac{1}{2} = 38687\frac{1}{2}$.

Then $\$38687\frac{1}{2} \div 100$, or cut off two right hand figures -- dollars, and you have $\$386.87\frac{1}{2}$, answer.

2. A merchant had his store, valued at 3500 dollars, insured for 2500 dollars, at $1\frac{1}{2}$ per cent, and goods, valued at 10000 dollars, insured for 8000 dollars, at $\frac{1}{2}$ per cent. A fire breaking out, his store was destroyed; and goods, to the amount of 2500 dollars, only, were saved; what was the amount of his loss, including the premium paid, and what was the amount of loss to the underwriters, after deducting the premium received?

Ans. { The merchant's loss, \$583.75.
The underwriters' loss \$10416.25.

3. Three merchants, A. B. and C. fitted out a ship and cargo, valued at 35750 dollars, and had 28000 dollars insured upon her, at $2\frac{1}{2}$ per cent. A. owned $\frac{1}{3}$, B. $\frac{1}{3}$, and C. $\frac{1}{3}$ of the ship and cargo: the ship struck a sand bar, and was entirely lost, with her cargo; what was each partner's loss, including his share of the premium paid; and what was the whole loss to the underwriters, after deducting the premium received?

Ans. A.'s loss, \$3195. B.'s, \$3195. And C.'s, \$2130. Loss to underwriters, \$22730.

4. What premium must be paid for the insurance of a house, valued at 2475 dollars, at $2\frac{1}{4}$ per cent? *Ans.* \$57.75.

CASE SECOND.

Q. What is meant by taking out a policy to cover a certain amount of goods or other property?

A. Goods and other property are said to be covered, when their value, together with the premium and other charges are insured.

Q. What is the RULE for finding the amount, for which a policy must be taken out to cover a given sum, including premium, &c.?

A. Subtract the premium per cent, from 100 dollars; then, by the rule of three, say, as the remainder : is to 100 :: so is the sum to be insured : to the amount of the policy.

EXAMPLES.

1. For what amount must a policy be taken out, to cover 5850 dollars, premium of insurance 5 per cent?

Operation.

$100 - 5 = 95$; then as $95 : 100 :: 5850 : 6157.89$ — *Ans.*

2. A merchant has a ship and cargo valued at \$25750, which

is insured for 15000 dollars, at 2 per cent, covering the premium; for what

sum must a policy be taken?

Ans. \$27248.67.

What sum must be taken out to cover \$15000; premium,

at 2 per cent home?

Ans. 16666.66.

4. If a ship and cargo, valued at \$21460, be insured to Canton, at $3\frac{1}{2}$ per cent, and home, at $2\frac{1}{2}$ per cent, what amount of policy will cover the whole ?
Ans. \$22829,78.

BUYING AND SELLING STOCKS.

Q. What is to be understood by the term, Stock ?

A. It is a general name for the capital of trading companies, or a fund established by government, or by corporate bodies ; such as banks, insurance offices, &c. the value of which varies, according to the prosperity or depression of business, or other circumstances of the times.

Q. When is stock said to be above par ?

A. When the shares are worth more than their original cost.

Q. When is stock said to be below par ?

A. When the shares are worth less than their first cost.

Q. What is the RULE for finding the present value of any amount of stock, when the shares are above par ?

A. Multiply the given amount, by the excess, above 100, and cut off the two right hand figures of dollars, as in Simple Interest, and you will have the premium or advance on the first cost, which being added to the given sum, will be the answer.

Q. When stock is below par value, how do you find the present value of any given amount ?

A. Multiply the given amount by the rate or value per cent, and cut off the figures as before directed, and you will have the purchase price.

Q. What general rule will apply, when stock is either above or below par value ?

A. By the rule of three say, as 100 dollars : is to the value of the stock per cent :: so is the given amount : to its present value. Or, which will, in either case, be the same, multiply the given amount by the value per cent, and cut off two figures as in simple interest, and you will have the answer.

EXAMPLES.

1. What must I give for \$9650 of original bank stock, at 125 per cent ? Say as 100 : 125 :: 9650 : to the

Ans. 12062,50 cts.

2. What will the purchase of 14820 dollars, of government 8 per cent stock, amount to, at $127\frac{1}{2}$ per cent

Operation. $14820 \times 127\frac{1}{2} = 1889550$. The

figures, and you have the

Ans

3. What is the present value of \$25750 of 3 per cent government stock, valued at 65 per cent? *Ans.* \$16737,50

4. A gentleman bought 75 bank shares, the original cost of which was 100 dollars a share, at $3\frac{1}{2}$ per cent advance, with interest on the original shares, from April 1st, to August 21st; what was the whole amount? *Ans.* \$7940.

5. When 4 per cent stock is sold at 31 per cent discount, what is the value of \$27860 at that rate? *Ans.* \$19,223,40.

6. A merchant sold a bill of exchange on England, for £7500 sterling, at $12\frac{1}{2}$ per cent advance, and paid a money broker $\frac{1}{2}$ per cent on the whole amount of sale, for doing the business; how many dollars did the whole amount to, and how much did he gain in premium, after deducting the brokerage?

Ans. { Whole amount \$37500.
Gain in premium \$3979,167 m.

7. In 1813, a gentleman bought 25000 dollars of government exchequer bills, drawing 6 per cent interest, at 85 per cent; in 1818 he sold the same at $104\frac{1}{2}$ per cent; what was his gain on the whole, including the interest from the time of purchase, to the time of sale? *Ans.* \$12375.

8. What must I pay for 3745 dollars of bank stock, at 105 per cent? *Ans.* \$3932,25 cts.

EQUATION OF PAYMENTS.

Q. What is Equation of Payments?

A. It is finding the equated time, to pay at once, several debts, which are due at different periods of time, so as to be equal to both parties.

Q. What is the RULE?

A. Multiply each payment by the time it has to run, and add the several products together; then divide their sum by the amount of the several debts, and the quotient will be the equated time for the payment of the whole.

EXAMPLES.

1. A man owes 600 dollars, payable as follows, viz.: \$200 in 3 months, 200 in 4 months, and 200 in 6 months; at what time must he pay the whole debt?

Operation. $200 \times 3 = 600$
 $200 \times 4 = 800$
 $200 \times 6 = 1200$

$2600 \div 600 = 4\frac{1}{3}$ months, *Ans.*

2. A merchant bought goods, to the amount of 4000 dollars, on the following credits, viz.: \$1000 on 30 days, \$1000 on 60 days, 1000 on 90 days, and 1000 on 120 days, but wishes to pay the whole at one time; in what time must the payment be made?

Ans. 75 days.

3. A commission merchant sold for his correspondent, goods, as follows, viz.: \$600 on 2 months credit, \$800 on 3 months, \$1200 on 4 months, and \$1000 on 6 months; what will be the equated time for the payment of the whole, and how much ready money will pay the whole, after deducting 5 per cent commission, on amount of sales, and 6 per cent interest from the neat amount?

Ans. { Equated time, 4 months.
Amount paid, \$3351.60.

4. A man sold his farm for 7200 dollars, payable $\frac{1}{2}$ in 6 months, $\frac{1}{3}$ in 8 months, and $\frac{1}{6}$ in 12 months; what will be the equated time to pay the whole? and how much interest must be deducted for prompt pay, at 6 per cent per annum?

Ans. { Equated time, $7\frac{2}{3}$ months, or 7 months, 20 days.
Interest deducted, 276 dollars.

5. A merchant sent 100 hogsheads of molasses to New-York, containing 12000 gallons, which sold for $31\frac{1}{4}$ cents a gallon, on 2, 4, and 6 months credit; at what time can the owner draw for the amount? and, allowing $4\frac{1}{2}$ per cent commission for selling, and deducting 7 per cent interest, how much ready money will discharge the debt?

Ans. { Equated time 4 months.
Amount paid \$3497.68.

6. A. owes to B. 698 dollars, to be paid, 151 dollars ready money, 247 dollars in 3 months, and 300 dollars in 8 months; what is the equated time for the payment of the whole? also, what discount must be made, if the whole be paid down, interest at 6 per cent?

Ans. { Equated time $4\frac{1}{2}$ months.
Interest deducted \$15.70 $\frac{1}{2}$ cts.

7. A man owes \$104.75, to be paid in $4\frac{1}{2}$ months; \$161, to be paid in $3\frac{1}{2}$ months; and \$152.25, to be paid in 5 months; what is the equated time for the payment of the whole? also, what amount of ready money will discharge the whole debt?

Ans. { Equated time 4 months, 9 days, nearly.
Amount of ready money, \$409.01,4 mills.

8. I owe a sum of money, to be paid in 4 equal payments, viz.: 2, 4, 6, and 8 months; but I agree to pay the whole at one time; at what time must the whole be paid?

Ans. 5 m.

9. A merchant sold goods as follows, viz.: 200 dollars on 30 days credit; 250 dollars on 60 days; 350 dollars on 90 days; 400 dollars on 4 months; 500 dollars on 6 months; and 100 dollars on 9 months; what will be the equated payment of the whole?

Ans.

ANNUITIES.

Q. What is meant by an Annuity ?

A. It is a sum of money, payable every year, for a certain number of years, or for life, or for an indefinite term of time.

Q. When is an annuity said to be Contingent ?

A. When it depends on some circumstance or contingency, as on the life of the person.

Q. When is an annuity said to be in Reversion ?

A. When it does not commence, until a certain number of years have elapsed.

Q. When is an annuity said to be in Arrears ?

A. When the debtor keeps the annuity in his own hands, and does not pay it at the stipulated time.

Q. What is meant by the Present worth of an annuity ?

A. When the annuity is bought off or paid all at once, at the beginning of the first year, the price, which is paid for it, is called the present worth ; and is such a sum as, if put to interest, would exactly pay the annuity as it became due.

Q. What is the Amount of an annuity ?

A. It is the sum of all the annuities for the time they have been forborne, together with the interest due on each.

CASE FIRST.

Q. What is the first Case ?

A. It is to find the amount of an annuity, at simple interest.

Q. What is the RULE in this case ?

A. Find the interest of the given annuity for one year, then for 2, 3, 4, &c. up to the number of years, less, by one, and their sum will be the whole interest ; then multiply the given annuity by the number of years, and add the product to the whole interest, and the sum will be the amount sought.

Q. Why do you not find the interest for the whole number of years, instead of the number less, by one ?

A. Because one year elapses before the annuity become due, therefore no interest is due on the first year.

Q. There is another RULE for finding the amount of an annuity at simple interest ; what is that ?

A. Add together the series of numbers, 1, 2, 3, 4, &c. to the number, less, by one, than the given number of years, then multiply the sum by the interest of the annuity for one year, and the product will be the whole interest. Multiply the annuity by the number of years, and add this product to the interest, and the sum will be the amount.

EXAMPLES.

1. What is the amount of an annuity of 200 dollars, for 5 years, with interest at 6 per cent?

Operation by Rule 1.

Interest of 200 dollars for 1 year=12

" 200 " 2 " 24

" 200 " 3 " 36

" 200 " 4 " 48

$\$120$ amount of interest.

The $\$200 \times 5 = 1000 + 120 = 1120$ dollars, answer.

By RULE 2. $1+2+3+4=10 \times 12 = \$120$ amount of interest.

Then $\$200 \times 5 + 120 = 1120$ dollars answer, as before.

2. A gentleman let his house for 10 years, at a rent of 250 dollars a year; what is the whole amount, computing interest at 6 per cent?

Operation. $1+2+3+4+5+6+7+8+9=45$ sum of the series.

Interest of $\$250$ for 1 year is $\$15 \times 45 = \$675$ whole interest.

Then $\$250 \times 10 = 2500 + 675 = 3175$ dollars. *Ans.*

3. If I lease a farm for 5 years, at a rent of 300 dollars a year, what will it amount to, with interest at 5 per cent per annum?

Ans. 1650 dollars.

4. What will an annuity of 150 dollars amount to in 6 years, at 7 per cent?

Ans. 1057 dollars, 50 cts.

5. If I hire a man for 12 months, at 25 dollars a month, and agree to pay him monthly, but retain the money in my own hands, till the end of the year, how much must I then pay him, allowing money to be worth $1\frac{1}{2}$ per cent a month?

Ans. $\$324,75$.

6. If a pension of 33 dollars be forborne 12 years, what will it amount to, at 7 per cent?

Ans. 548 dollars, 46 cents.

CASE SECOND.

Q. What is the Second Case?

A. It is when the present worth of the annuit

Q. What is the RULE?

A. By the rule of Discount find the present year, separately, discounting from the time i
the sum of all these present worths will be the -

N^o

EXAMPLES.

1. What will be the present worth of an annuity of 100 dollars, to continue 4 years, discounting 6 per cent?

Say as 106 } 100 : 94,339 present worth of 1 year.
 112 } : 100 :: { 100 : 89,285 " " 2 "
 118 } { 100 : 84,745 " " 3 "
 124 } { 100 : 80,645 " " 4 "

Ans. \$349,01,4.

2. If a house be leased for 5 years, at 250 dollars a year, what amount will pay the whole rent, at the commencement of the term, discounting 6 per cent? *Ans.* \$1064,846 m.

3. What is the present worth of \$400 per annum, to continue 4 years, discounting 6 per cent? *Ans.* \$1396,064.

4. If a store be let for 3 years, at 100 dollars a year, how much ready money will pay the whole rent, at 6 per cent discount? *Ans.* \$268,37.

5. A gentleman leased an estate for 5 years, at 300 dollars a year; at the expiration of which he leased it again, to the same person, for 5 years more, at 250 a year; as the rent on the first lease is still in arrear, it is required to know what amount will pay the 10 years rent, reckoning interest and discount at 6 per cent? *Ans.* \$2744,846 m.

6. What is the present worth of an annuity of 150 dollars a year, payable half yearly, and to continue 3 years, discounting 6 per cent? *Ans.* \$408,121 m.

7. What amount must be given for an annuity of \$500, for six years; 4 years of which are in arrear, reckoning interest on the arrear at 6 per cent, and discounting, for the present worth, 7 per cent? *Ans.* \$3085,885 m.

LOSS AND GAIN.

Q. What is Loss and Gain?

A. It is a rule by which merchants and traders find their profit and loss in buying and selling goods. It also teaches them to fix the prices of their goods, so as to gain or lose so much per cent.

Q. What RULE is most applicable to answering questions in Loss and Gain?

A. The Rule of Three Direct.

CASE FIRST.

Q. What is the first case in Loss and Gain ?

A. It is, when an article is sold at a certain profit or loss, to find what that profit or loss is per cent, or how much on 100 dollars.

Q. What is the RULE in this case ?

A. First, find the whole gain or loss by subtraction, then by the Rule of Three, say, as the price it cost : is to the whole gain or loss : so is 100 : to the gain or loss per cent ; or, which is the same, annex two ciphers to the whole gain or loss, and divide it by the price it cost, and the quotient will be the gain or loss per cent.

EXAMPLES.

1. If I buy cloth at 85 cents a yard, and sell it again at 90 cents, what is my gain per cent ?

Operation. From the selling price, 90 cents
Deduct the purchase price, 85 cents

And you then have 5 cts. gain per yard.

Then say, $85 : 5 :: 100 : 5\frac{1}{2}$. *Ans.* $5\frac{1}{2}$ or \$5.88. +

2. If I buy cloth at 90 cents a yard, and am forced to sell it at 85 cents, what do I lose per cent ? *Ans.* $5\frac{1}{2}$ or \$5.55. +

3. A merchant imported 12 bales of cloth, each containing 10 pieces, which, together with the charges of shipping, amounted to \$360 ; he paid duties here, 92 cents a piece ; freight \$12 ; and portage \$1.25 ; what does it stand him in, per piece, and what will he gain per cent, if he sell it at \$4.43 $\frac{1}{2}$ cents the piece ? *Ans.* 10 per cent. Will stand him in \$4.03 per piece.

4. Bought a farm for 5000 dollars, and hired the money at 6 per cent to pay for it ; at the end of 2 years, I sold it for 6000 dollars ; what do I gain per cent, after paying the interest ? *Ans.* 8 per cent.

5. A merchant bought 4 pieces of satin, each containing 36 yards, at 45 dollars a piece, and retailed two pieces of it at \$1.87 $\frac{1}{2}$ a yard, and the other two pieces at \$1.50 a yard ; what was his whole gain, and how much per cent ?

Ans. Whole gain \$63. Gain per cent 35 dollars.

6. Bought 50 bank shares, including 6 months interest on them, for 55 dollars a share, and sold them again, at 54 dollars a share, charging 6 months interest to the seller. *Ans.* I gained 1 $\frac{7}{55}$ or \$1.27 w

7. If I buy a lot of goods, amounting to 750 dollars, on 4 months credit, and sell the same for 800 dollars in cash, what is my gain on the purchase, and how much per cent, allowing money to be worth 6 per cent a year ?*

Ans. My neat gain is \$65. My gain per cent is \$8,84+.

8. A merchant bought 60 yards of broadcloth at $4\frac{1}{2}$ dollars a yard, and 38 yards of cassimere at $2\frac{1}{2}$ dollars a yard, and sold them together for $4\frac{1}{2}$ dollars a yard; what was his whole gain, and how much per cent?

Ans. His whole gain \$51,50. His gain per cent \$14,11.

CASE SECOND.

Q. What is the Second Case in Loss and Gain?

A. It is to find how a commodity must be sold to gain or lose so much per cent.

Q. What is the RULE in this case?

A. By the Rule of Three, say, as 100 : is to the purchase price :: so is 100 with the gain per cent added, or loss per cent subtracted : to the selling price.

EXAMPLES.

1. A merchant bought a quantity of silks for 90 cents a yard; how must he sell them a yard to gain $13\frac{1}{2}$ per cent?

Operation. $100 + 13\frac{1}{2} = 113\frac{1}{2}$

Then say, as $100 : 90 :: 113\frac{1}{2} : 1,0215$. *Ans.* \$1,02.

2. If I buy 100 barrels of flour for 750 dollars, how must I sell it a barrel, to gain $12\frac{1}{2}$ per cent? *Ans.* \$8,43 $\frac{1}{2}$ cts.

3. A merchant bought in New-York, 4 pipes of Madeira wine, containing 125 gall. each, at \$2,50 a gall.; paid freight and other expenses, amounting to \$5,25 a pipe; by accident 15 gall. leaked out; how must he sell it a gallon to gain 20 per cent on the whole purchase? *Ans.* \$3,144+m.

4. Bought a bale of broadcloths, containing 14 pieces, each piece contained 25 yards, at \$4,50 a yard; but, proving to be damaged, I have 8 per cent deduction allowed me; what do it stand me in per yard, and at what price must I sell it per yard, to gain 12 per cent on the purchase?

Ans. { It stands me in \$4,14 a yard.
 { I must sell it at \$4,63,6 $\frac{8}{10}$ m.

unts in this Rule are made by the Merchant

CASE THIRD.

Q. What is the third case in Loss and Gain?

A. It is when the gain or loss per cent is given, to find what the commodity cost.

Q. What is the RULE in this case?

A. By the Rule of Three, say, as 100 : with the gain per cent added, or loss per cent subtracted, is to the selling price :: so is 100 : to the price it cost.

EXAMPLES.

1. If 12 yards of cloth be sold for 2 dollars, 50 cents a yard, and there is lost $7\frac{1}{2}$ per cent, what did the whole cost?

Operation. $\$2.50 \times 12 \text{ yards} = \$30$ amount sold for.

Then $100 - 7\frac{1}{2} = 92\frac{1}{2}$. Then, as $92\frac{1}{2} : 30 :: 100 : 32,43,2+$

Ans. $\$32,43,2 \text{ m.}$

2. A merchant sold 100 yards of cloth, at 3 dollars, 75 cents a yard, by which he gained 25 per cent; what did it cost a yard?

Ans. 3 dollars.

3. A grocer bought a hogshead of rum, but being deceived in the quality, could not sell it for more than $102\frac{1}{2}$ cents a gallon, by which he lost 18 per cent; what was the purchase price?

Ans. $\$1,25.$

4. If a man sell a cow for $\$13,50$, and thereby lose 10 per cent, how much did she cost him?

Ans. $\$15.$

5. A. travels 14 miles an hour, and thereby gains 20 per ct. on B.; at what rate does B. travel?

Ans. $11\frac{2}{3}$ miles an hour.

6. If 250 gallons of wine be sold for $\$1,08$ a gallon, and 20 per cent be gained by the sale of it, what will be gained on the whole, and how much did it cost a gallon?

Ans. Whole gain $\$45.$ Cost per gallon $\$0,90 \text{ cts.}$

CASE FOURTH.

Q. What is the fourth case in Loss and Gain?

A. It is, when goods are sold at a certain price, and there is gained or lost so much per cent, to find what would be gained or lost per cent, if sold at a different price?

Q. What is the RULE in this case?

A. By the Rule of Three; say, as the first price : is to 100, with the gain per cent added, or loss per cent subtracted :: so is the other price : to the gain or loss per cent required
if the answer exceed $\$100$, the excess is the gain
but if it be less than $\$100$, the deficiency is the loss

EXAMPLES.

1. If by selling cloth at 80 cents a yard, you gain 12 per cent, what will be your gain per cent when you sell it at 1 dollar a yard?

Operation. $100 + 12 = 112$. Then, as $80 : 112 :: 100 : 140$
Therefore $140 - 100 = 40$ per cent. *Ans.*

2. If by selling sugar at 8 dollars the cwt. I lose 12 per cent, what shall I gain or lose, if I sell it at 9 dollars the cwt.?

Ans. I lose 1 per cent.

3. Bought a quantity of wine, a part of which I sold at \$1,50 a gallon, by which I gained 25 per cent. The article falling in price, I was obliged to sell the residue at \$1,08 a gallon; did I gain or lose on the residue, and how much per cent?

Ans. Lost 10 per cent.

4. A. stole a horse from B. and made off with him; five days after, B. gets intelligence of his direction, and follows him at the rate of 60 miles a day, by which he gains 20 per cent upon A. At what rate did A. travel; how far must B. ride before he overtakes A.; and how many days will it require for B. to overtake him?

Ans. { A. travelled 50 miles a day.
B. must ride 1500 miles before he overtakes him.
It will require 25 days to catch A.

5. A merchant sold a piece of broadcloth for 50 dollars, by which he lost 17 per cent, whereas he ought to have gained 20 per cent in the trade; what was the first cost of the cloth, and how much was it sold under the real value?

Ans. { First cost 60 dollars, 24 cts.
Under value 22 dollars, 28,8 mills.

6. A grocer bought 3 hds. of rum, as follows, viz.: No. 1, 114 galls. at $87\frac{1}{2}$ cts. a gallon; No. 2, 120 galls. at 95 cts.; and No. 3, 125 galls. at 110 cts. a gallon; it being high proof, he put 15 gallons of water into it, and sold the whole at one dollar a gallon; what was the whole gain or loss, and how much per cent?

Ans. { His whole gain \$22,75 cts.
Gain per cent \$6,47,6+mills.

7. A stationer bought 50 thousand quills, 25 thousand of which, he sold at \$5 a thousand, by which he gained 25 per cent; the article rising in value, he sold the remaining 25 thousand at a price, by which he gained $37\frac{1}{2}$ per cent; what was the first cost; what was the last parcel sold at per thousand; and what was his whole gain in the trade? *Ans.* First cost \$4 per thousand. Last price sold at \$5,50. Whole gain \$62

FRACTIONS.

Q. What are Fractions?

A. They are broken numbers, and are used to express any assignable part of an unit or whole number; as, one half, one fourth, or three-fourths, &c. of any quantity or thing.

Q. What is the first grand division of fractions?

A. Into Vulgar and Decimal.

VULGAR FRACTIONS.

Q. How is a Vulgar Fraction expressed or written?

A. By two numbers, placed one above the other, and a line drawn between them, as $\frac{1}{2}$, $\frac{4}{5}$, $\frac{7}{8}$, &c.

Q. What name is given to the numbers that express a fraction?

A. The figure above the line is called the Numerator, and that below the line is called the Denominator.

Q. What do fractions arise from?

A. All fractions arise from division.

Q. In what way do fractions arise from division?

A. When any sum or number is divided, and there is a remainder, this remainder is a numerator, and the divisor is the denominator of a fraction.

Q. What then does the denominator of a fraction always show?

A. It shows how many parts the whole number is divided into.

Q. What does the numerator show?

A. It shows how many of those parts are meant by the fraction.

Q. How are Vulgar Fractions divided?

A. They are divided into five sorts, viz.: single or simple, proper, improper, compound, and mixed.

Q. What is a single or simple fraction?

A. It is a fraction expressed in a simple form, as $\frac{1}{2}$, $\frac{3}{4}$, $\frac{7}{8}$.

Q. What is a proper fraction?

A. It is a fraction whose numerator is less than the denominator, as $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{8}$, &c.

Q. What is an improper fraction?

A. A fraction whose numerator is greater than the denominator, as, $\frac{3}{2}$, $\frac{5}{4}$, $\frac{7}{3}$, &c.

Q. What is a compound fraction?

A. It is a fraction of a fraction, expressed in a compound form, as $\frac{1}{2}$ of $\frac{3}{4}$, $\frac{2}{3}$ of $\frac{7}{8}$ of 14, &c.

Q. What is a mixed number ?

A. It is a whole number, joined with a fraction, as $14\frac{1}{2}$, $7\frac{1}{4}$, $15\frac{3}{4}$, $137\frac{15}{24}$, &c.

Q. How can any whole number be expressed like a fraction ?

A. By drawing a line under it, and writing an unit or one for a denominator, as 8 may be expressed $\frac{8}{1}$, or 16 may be expressed $\frac{16}{2}$, &c.

Q. What is a prime number ?

A. It is such a number as cannot be divided, or measured, without a remainder, except by itself or an unit; as 3, 5, 7, 23, 37, &c.

Q. What is a perfect number ?

A. It is a number that is equal to the sum of all its aliquot parts, as 6, 28, &c.

Q. When is a fraction said to be in its least or lowest terms ?

A. When it is expressed by the least numbers possible; that is, when both the terms of the fraction cannot be divided by any figure greater than 1, without a remainder : as $\frac{7}{13}$, $\frac{15}{28}$, &c.

CASE FIRST.

Q. What is the first case in Vulgar Fractions ?

A. It is to find the common measure of two or more numbers.

Q. What is meant by the common measure of any two, or more numbers ?

A. It is such a number, as will divide each of the given numbers, without a remainder; if it be the greatest number that will so divide them, it is called the greatest common measure.

Q. What is the RULE for finding the greatest common measure of two numbers ?

A. Divide the greater number by the less, and that divisor, by the last remainder, and thus continue to divide the last divisor, by the last remainder, till nothing remains, and the last divisor will be the greatest common measure.

Q. When there are more than two numbers given, how do you find the common measure of them all ?

A. Find the common measure of any two of the given numbers as before, then of that common measure and one of the numbers, and so on, through all the given numbers, and the common measure will be the greatest number that will all the given numbers without a remainder.

EXAMPLES.

1. What is the greatest common measure of 1836, 3996, and 1044?

Operation. $1836)3996(2$
 3672

$324)1836(5$
 1620

Here it is seen that 108 is the greatest common measure of 1836, and 3996. The next process is, to find the common measure of 108, and 1044, as follows, viz.:

$216)324(1$
 216
 $108)216(2$
 216

$108)1044(9$
 972

Here it is seen that 36 is the last common measure, and is therefore the greatest common measure of the three given numbers, and is the answer required.

$72)108(1$
 72
 $36)72(2$
 72

2. What is the greatest common measure of 182, and 392?
Ans. 14.
3. What is the greatest common measure of 1224, and 1080?
Ans. 72.
4. What is the greatest common measure of 1440, 672, and 3472?
Ans. 16.
5. What is the greatest number that will divide 288, and 480, without a remainder?
Ans. 96.
6. What is the greatest number that will divide 128, and 160, without a remainder?
Ans. 32.

CASE SECOND.

Q. What is the second case in Vulgar Fractions?

A. It is to find the common multiple of several given numbers?

Q. What is meant by the common multiple of several numbers?

A. It is such a number as can be divided by each of the given numbers, without a remainder. If it be the least number that can be so divided, it is called the least common multiple.

Q. What is the RULE for finding the least common multiple of any given numbers ?

A. Write down all the given numbers in a row, with a separator between them ; then divide them by any number that will divide two or more of them, without a remainder ; set the quotients and the undivided figures in a line beneath ; divide this line again as before, and thus continue, till there are no two numbers that can be divided by the same figures ; then multiply all the figures in the quotients and divisors continually together, and their product will be the least common multiple.

EXAMPLES.

1. What is the least common multiple of 5, 8, 12, and 16?

Operation. $4 \overline{) 5, 8, 12, 16}$

$2 \overline{) 5, 2, 3, 4}$

$5, 1, 3, 2$

No two numbers can be divided.
Therefore $4 \times 2 \times 5 \times 3 \times 2 = 240$, least common multiple.

2. What is the least number that can be divided by 12, 14, 16, and 18 ?

Ans. 1008.

3. What is the common multiple of 3, 6, 9, 12, and 15 ?

Ans. 180.

4. What is the least number that can be divided by the nine digits ?

Ans. 2520.

5. What is the least common multiple of 2, 4, 6, 5, 7, and 9 ?

Ans. 1260.

6. What is the least common multiple of 3, 5, 7, 9, 11, 13, 15, 17, 19, and 21 ?

Ans. 14, 549, 535.

REDUCTION OF VULGAR FRACTIONS.

Q. What are you taught by Reduction of Vulgar Fractions?

A. We are taught to bring them out of one form into another, without altering their value, and also, to prepare them for addition, subtraction, multiplication and division.

Q. Under how many different cases is reduction of Vulgar Fractions performed ?

A. Ten different operations are performed in reduction of vulgar fractions, and it is, therefore, arranged under ten different cases.

CASE FIRST.

What is the first case ?

It is to abbreviate or reduce a fraction to its least or

Q. What is the RULE in this case ?

A. Divide each term of the fraction, by any number that will divide them both, without a remainder, and these quotients again, in the same manner, and thus continue, till there is no number, greater than 1, that will divide both the terms without a remainder, and the fraction will then be in its least term; or, divide both the terms of the fraction, by their greatest common measure, and these quotients will be the least terms of the fraction.

EXAMPLES.

1. Reduce $\frac{238}{1152}$ to its lowest term.

Divisors (12) (12) (2)

Operation. Fraction $288=24=2=1$

$$1152=96=3=4$$

2. Reduce $\frac{57}{456}$ to its lowest term.

Ans. $\frac{1}{8}$.

3. Reduce $\frac{171}{180}$ to its lowest term.

Ans. $\frac{19}{20}$.

4. Reduce $\frac{1429}{2858}$ to its lowest terms.

Ans. $\frac{1}{2}$.

5. What will be the least expression of $\frac{164}{398}$?

Ans. $\frac{82}{199}$.

6. Reduce $\frac{114}{285}$ to its lowest terms.

Ans. $\frac{2}{5}$.

7. What is the least expression of $\frac{3619}{8231}$?

Ans. $\frac{11}{15}$.

8. Reduce $\frac{216}{288}$ to its lowest terms.

Ans. $\frac{3}{4}$.

CASE SECOND.

Q. What is the second case in Reduction of Vulgar Fractions ?

A. To bring mixed numbers to improper fractions.

Q. What is the RULE in this case ?

A. Multiply the whole number by the denominator of the fraction, and add in the numerator, then write this product over the denominator of the fraction, and it will form the improper fraction required.

EXAMPLES.

1. Reduce $16\frac{1}{8}$ to an improper fraction ?

Operation. $16 \times 8 + 1 = 129$ Ans.

2. Reduce $24\frac{6}{8}$ to an improper fraction, and also to its lowest terms.

Ans. $\frac{99}{4}$.

3. Reduce $9\frac{9}{12}$ to its lowest terms, in an improper fraction.

Ans. $\frac{29}{3}$.

4. What is the least fractional expression of $128\frac{1}{16}$?

Ans. 16 .

5. Reduce $374\frac{214}{43}$ to its equivalent improper fraction.
Ans. $278\frac{196}{43}$.
6. Reduce $146\frac{12}{18}$ to an improper fraction, and also to its lowest terms.
Ans. $23\frac{29}{10}$.
7. What is the least fractional expression of $4163\frac{174}{68}$?
Ans. $3247\frac{43}{18}$.
8. Bring $364\frac{5}{8}$ to its least fractional expression. *Ans.* $1459\frac{1}{8}$.
9. How many eighths are contained in $763\frac{5}{8}$? *Ans.* $6199\frac{5}{8}$.
10. How many sixteenths are contained in $736\frac{13}{16}$?
Ans. $11779\frac{13}{16}$.

CASE THIRD.

- Q. What is the third case in Reduction of Fractions?
 A. To reduce an improper fraction to an equivalent whole or mixed number.
- Q. What is the RULE in this case?
 A. Divide the numerator by the denominator of the fraction, and the quotient will be the whole number: if there be a remainder, it will be a numerator to the given denominator, and must be placed at the right hand of the quotient, which will express the same value, as the given fraction.

EXAMPLES.

1. Reduce $1\frac{29}{8}$ to a whole or mixed number. *Ans.* $16\frac{1}{8}$.
2. Reduce $2\frac{27}{24}$ to a whole or mixed number. *Ans.* $12\frac{9}{4}$.
3. What is the value of $1\frac{16}{12}$? *Ans.* $9\frac{1}{3}$.
4. What is the value of $2\frac{62}{18}$? *Ans.* $128\frac{7}{9}$.
5. What is the value of $4\frac{76}{80}$? *Ans.* $419\frac{19}{20}$.
6. What is the value of $9\frac{60}{14}$? *Ans.* $70\frac{3}{7}$.
7. What whole number is equal to $368\frac{7}{8}$? *Ans.* 46.
8. What mixed number is equal to $11779\frac{13}{16}$? *Ans.* $736\frac{3}{16}$.
9. What whole number is equal to $2336\frac{7}{16}$? *Ans.* 146.

CASE FOURTH.

- Q. What is the fourth case in Reduction of Fractions?
 A. To reduce any whole number to an equivalent fraction, having a given denominator.
- Q. What is the RULE in this case?
 A. Multiply the whole number, by the given denominator, and the product, write the given denominator, and you are required.

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EXAMPLES.

1. Reduce 8 to a fraction, whose denominator shall be 12.
Operation. $8 \times 12 = 96$; then $\frac{96}{12}$ is the answer.
2. Reduce 16 to a fraction, whose denominator shall be 24.
Ans. $\frac{384}{24}$.
3. What fraction, having 48 for a denominator, will be equal to 36?
Ans. $\frac{1728}{48}$.
4. What numerator must be written over 19, to make a fraction equal in value to 9?
Ans. 171.
5. Reduce 75 to a fraction, having 36 for a denominator.
Ans. $\frac{2700}{36}$.
6. Reduce 13 to a fraction, having 7 for a denominator.
Ans. $\frac{91}{7}$.

CASE FIFTH.

- Q. What is the fifth case in Reduction of Fractions?
A. To reduce compound fractions to simple ones of equal value.
- Q. What is the RULE in this case?
A. First, reduce all whole or mixed numbers to equivalent improper fractions; then multiply all the numerators together, for a new numerator, and all the denominators together, for a new denominator, and you will have the fraction required.

EXAMPLES.

1. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a simple fraction.
Operation. $1 \times 2 \times 3 \times 4 = 24$ new numerator.

$$2 \times 3 \times 4 \times 5 = 120 \text{ new denominator.}$$

- Ans.* $\frac{24}{120}$ or $\frac{1}{5}$.
2. Reduce $\frac{4}{5}$ of $\frac{5}{6}$ of $16\frac{1}{2}$ to a simple fraction. *Ans.* $\frac{924}{80}$ or $\frac{231}{20}$.
 3. What is the least simple expression of $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{5}{6}$ of $\frac{7}{8}$ of $\frac{9}{10}$?
Ans. $\frac{14}{10}$.
 4. What is the value of $\frac{4}{5}$ of $\frac{3}{4}$ of $\frac{1}{2}$ of $18\frac{1}{2}$? *Ans.* $5\frac{7}{10}$.
 5. A merchant bought $\frac{1}{10}$ of a ship, for 9000 dollars, and sold to A. $\frac{1}{2}$ of his share; A. sold to B. $\frac{2}{3}$ of his share; B. sold $\frac{3}{4}$ of his share to C.; and C. again, sold $\frac{5}{6}$ of his share to D.; what part of the ship did each man buy, and how much did he give for his purchase?

<i>Ans.</i>	{	A. bought $\frac{1}{2}$ of the ship for \$4500.
		B. bought $\frac{1}{4}$ of it for \$3000.
		C. bought $\frac{3}{8}$ of it for \$1800.
		D. bought $\frac{3}{12}$ of it for \$1125.

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6. What simple fraction is equal in value to $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{7}{8}$?

Ans. $\frac{7}{12}$.

7. If I buy $\frac{1}{4}$ of $\frac{1}{5}$ of $\frac{6}{15}$ of a manufacturing establishment, the whole of which is worth 25,000 dollars; what must I pay for my share?

Ans. 4375 dollars.

CASE SIXTH.

Q. What is the sixth case in Reduction of Fractions?

A. To reduce fractions, of different denominators, to fractions having the same, or a common denominator.

Q. What is the RULE in this Case?

A. First, reduce all compound fractions to simple ones, and all whole, or mixed numbers, to improper fractions; then multiply each numerator into all the denominators, except its own, for new numerators; then multiply all the denominators together for the common denominator, and this new denominator, written under the several new numerators, will form the fractions required.

EXAMPLES.

1. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{5}{8}$, and $\frac{6}{7}$, to fractions having a common denominator.

Operation.
$$\begin{array}{l} 1 \times 4 \times 8 \times 7 = 224 \\ 3 \times 2 \times 8 \times 7 = 336 \\ 5 \times 2 \times 4 \times 7 = 280 \\ 6 \times 2 \times 4 \times 8 = 384 \end{array} \left. \vphantom{\begin{array}{l} 1 \times 4 \times 8 \times 7 \\ 3 \times 2 \times 8 \times 7 \\ 5 \times 2 \times 4 \times 7 \\ 6 \times 2 \times 4 \times 8 \end{array}} \right\} \text{New numerators.}$$

$2 \times 4 \times 8 \times 7 = 448$ Common denominator.

The fractions, thus reduced, stand $\frac{224}{448}$, $\frac{336}{448}$, $\frac{280}{448}$, $\frac{384}{448}$. *Ans.*

2. Reduce $\frac{2}{3}$, $\frac{7}{8}$ of $\frac{1}{2}$, and $\frac{3}{4}$, to a common denominator.

Ans. $\frac{480}{1792}$, $\frac{378}{1792}$, $\frac{384}{1792}$.

3. Reduce $\frac{1}{2}$, $\frac{3}{4}$, and $7\frac{3}{4}$, to a common denominator.

Ans. $\frac{120}{160}$, $\frac{80}{160}$, $\frac{1184}{160}$.

4. Reduce $\frac{3}{4}$, $\frac{2}{3}$, $\frac{7}{8}$ of $\frac{5}{11}$, and $\frac{1}{2}$ of $14\frac{1}{2}$, to a common denominator.

Ans. $\frac{13200}{359680}$, $\frac{29568}{359680}$, $\frac{11520}{359680}$, $\frac{181720}{359680}$.

5. Reduce $\frac{1}{2}$ of $\frac{2}{3}$, $\frac{3}{4}$ of $\frac{4}{5}$, $\frac{5}{6}$ of $\frac{6}{7}$, and $\frac{7}{8}$ of $\frac{8}{9}$, to a common denominator.

Ans. $\frac{60480}{161280}$, $\frac{86016}{161280}$, $\frac{100800}{161280}$, $\frac{89120}{161280}$.

6. Reduce $\frac{2}{3}$ of 7, $\frac{1}{4}$ of 9, $\frac{3}{5}$ of 12, and $\frac{1}{6}$ of 16.

Ans. $\frac{1080}{420}$, $\frac{945}{420}$, $\frac{3024}{420}$, $\frac{3840}{420}$.

CASE SEVENTH.

What is the seventh case in Reduction of Fractions?
 Reduction of one denomination to fractions of
 another, retaining the same value.

Q. What is the RULE in this case ?

A. Reduce the given fraction to such a compound one, as will express the value of the given fraction, by comparing it with all the denominations, between it, and that to which you would reduce it: then reduce this compound fraction to a simple one, and you will have the fraction required.

EXAMPLES.

1. Reduce $\frac{1}{2}$ of a farthing, to the fraction of a pound.
Operation. Reduced to a compound fraction, it will stand thus, $\frac{1}{2}$ of $\frac{1}{12}$ of $\frac{1}{20}$; then $\frac{1}{2} \times \frac{1}{12} \times \frac{1}{20} = \frac{1}{1920}$. *Ans.*
2. Reduce $\frac{1}{4}$ of a penny, to the fraction of a pound. *Ans.* $\frac{1}{320}$.
3. Reduce $\frac{1}{8}$ of a pennyweight, to the fraction of a pound Troy. *Ans.* $\frac{1}{256}$.
4. Reduce $\frac{1}{2}$ of an ounce, to the fraction of a ton. *Ans.* $\frac{1}{40000}$.
5. Reduce $\frac{1}{3}$ of a pound, to the fraction of a cwt. *Ans.* $\frac{1}{336}$.
6. Reduce $\frac{1}{4}$ of an inch, to the fraction of a furlong. *Ans.* $\frac{1}{9216}$.
7. Reduce 9 inches, to the fraction of a mile. *Ans.* $\frac{1}{5280}$.
8. Reduce $\frac{1}{2}$ of a nail, to the fraction of a yard. *Ans.* $\frac{1}{36}$.
9. Reduce $\frac{1}{2}$ of $\frac{1}{3}$ of a pint, to the fraction of a hogshead, wine measure. *Ans.* $\frac{1}{1312}$.

CASE EIGHTH.

Q. What is the eighth case in Reduction of Fractions ?

A. To reduce fractions of a greater denomination, to fractions of a less, but retaining the same value.

Q. What is the RULE in this case ?

A. Multiply the numerator of the given fraction, by all the denominations between it and that denomination to which you would reduce it, for a new numerator, under which, write the given denominator; this fraction, being reduced to its least term, will be the answer.

EXAMPLES.

1. Reduce $\frac{1}{1920}$ of a pound, to the fraction of a farthing.
Operation. $1 \times 20 \times 12 \times 4 = 960$; then $\frac{960}{1920} = \frac{1}{2}$. *Ans.*
2. Reduce $\frac{1}{320}$ of a pound, to the fraction of a penny. *Ans.* $\frac{1}{4}$.
3. Reduce $\frac{5}{1440}$ of a pound Troy, to the fraction of a weight.
4. What part of an ounce, is $\frac{1}{40000}$ of a ton

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5. What part of a pound, is $\frac{4}{1008}$ of a hundred weight, (gross)? *Ans.* $\frac{1}{252}$.
6. If a furlong were divided into 9240 parts, what part of an inch would each of those parts be? *Ans.* $\frac{6}{7}$.
7. Reduce $\frac{1}{7040}$ of a mile, to the fraction of a foot. *Ans.* $\frac{9}{172}$ or $\frac{1}{19}$.
8. Reduce $\frac{3}{64}$ of a yard, to the fraction of a nail. *Ans.* $\frac{1}{4}$.
9. Bring $\frac{1}{1512}$ of a hhd. (wine measure,) to the fraction of a pint. *Ans.* $\frac{1}{3}$.

CASE NINTH.

- Q. What is the ninth case in Reduction of Fractions?
- A. To reduce a mixed quantity of coin, weight, or measure, to the simple fraction of an integer?
- Q. What is the RULE in this case?
- A. Reduce the given quantity to the lowest denomination given in it, for a numerator; then reduce the integer to the same denomination, for a denominator, and this fraction being reduced to its lowest term, will form the fraction required.

EXAMPLES.

1. Reduce 9 oz. 12 pwt. 14 grs., to the fraction of a pound, Troy.

Operation.	oz.	pwt.	grs.	lb.
	9	12	14	1
	20			12
	192			12
	24			20
	782			240
	384			24
Numerator.	4622			960
				480

5760 Denominator.

The fraction is $\frac{4622}{5760} = \frac{2311}{2880}$, *Ans.*

2. What part of a pound, is 18s. 4½d.? *Ans.* $\frac{147}{186}$.
3. Reduce 3 qrs. 14 lbs. 12 oz. 7 drs., to the fraction of a cwt. *Ans.* $\frac{23287}{33872}$.
4. Bring 7 fur. 34 rods, 1 yd. 2 ft. 11 inches, to the fraction ile. *Ans.* $\frac{82243}{64448}$.
- ing 145 days, 18 h. 40 m. 13½ sec., to the fraction of a *Ans.* $\frac{44933247}{17687666}$.

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6. Bring 8 dimes, 6 cents, 4 mills, to the fraction of an eagle.

Ans. $\frac{54}{633}$.

7. A grocer bought 4 casks of wine, each containing 118 $\frac{1}{2}$ galls., out of which he filled 5 quarter casks, containing 31 $\frac{4}{5}$ galls. each; what proportion of the whole was taken, and what proportion was left? *Ans.* $\frac{159}{475}$ was taken out. $\frac{316}{475}$ was left.

CASE TENTH.

Q. What is taught in the tenth case in Reduction of Fractions?

A. It teaches to find the value of fractions in the known parts of an integer, as of coin, weight, or measure.

Q. What is the RULE in this Case?

A. Multiply the numerator of the fraction, by the parts in the next lower denomination, and divide this product by the denominator, and if any thing remain, multiply this remainder by the parts in the next lower denomination, and divide this product by the denominator, as before; and thus continue to multiply and divide, till you have brought it to the lowest denomination required.

Q. How can you explain the reason for this operation?

A. This rule will appear perfectly plain and simple, if we compare it with the operation of Compound Division, and recollect, that the denominator of the fraction is the divisor in division, and the numerator of the fraction is the remainder in division; therefore, this process is only a continuation of the operation, according to the rule of Compound Division, by reducing the remainder to the next lower denomination, and dividing again by the given divisor, as far as the question requires.

EXAMPLES.

1. What is the value of $\frac{4}{15}$ of a pound, Troy?

Operation.

Divisor or denominator 15)4 the numerator or remainder.

$\times 12$ oz. parts in the next lower denomination.

15)48(3 oz.

45

—

3

$\times 20$ pwt. parts in the next lower denomination.

15)60(4 pwt.

60

—

Ans. 3 oz

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2. What is the value of $\frac{11}{12}$ of a cwt. ?

Ans. 3 qr. 18 lb. 10 oz. 10 $\frac{1}{2}$ dr.

3. If you were dividing any number of years by 17, and the remainder should be 12, what would be the value or proper quantity of this remainder ? *Ans.* 257 d. 19 h. 45 m. 52 $\frac{16}{17}$ sec.

4. Were you dividing acres by 7, and the remainder should be 6, what would its proper quantity be ? *Ans.* 3 rds. 17 $\frac{1}{2}$ rods.

5. If $\frac{17}{30}$ of a ton of sugar be divided equally among 29 persons, how much will each have for his share ?

Ans. 2 qr. 9 lb. 10 oz. 72 $\frac{1}{3}$ dr.

6. How much is $\frac{1}{3}$ of a yard ? *Ans.* 2 yds. 3 $\frac{1}{3}$ qrs.

7. What is the proper quantity of $\frac{3}{4}$ of an acre ?

Ans. 1 acre, 2 roods, 13 $\frac{1}{2}$ rods.

8. If 4 men purchase $\frac{1}{5}$ of an acre of ground, what is each man's share of the purchase ? *Ans.* 35 rods.

9. Five boys found a purse of money, containing $14^{\frac{1}{2}}$ of a dollar ; how much had each boy for his share ? *Ans.* \$3.50.

10. A man left $\frac{5}{8}$ of his farm, containing 176 acres, to 4 of his sons, and the residue to his 2 daughters ; what was the share of each son, and of each daughter ?

Ans. { Each son's share, 36 acres, 2 roods, 26 $\frac{1}{2}$ rods.
Each daughter, 14 acres, 2 roods, 26 $\frac{1}{2}$ rods.

ADDITION OF VULGAR FRACTIONS.

Q. What is the RULE for Addition of Vulgar Fractions ?

A. Reduce all compound fractions to simple ones, all mixed numbers to improper fractions, and fractions of different denominations, or integers, to those of the same ; then bring all these fractions to a common denominator, and the sum of all the numerators, written over the common denominator, will be the sum of the fractions required, (the value of which may be found by the preceding rules.)

Q. Is it always necessary, in preparing fractions for addition or subtraction, to reduce mixed numbers to improper fractions ?

A. It is not : If the fractional expressions are reduced to a common denominator, the whole numbers may be placed at the left hand, and added or subtracted as whole numbers.

Q. By what other rule can you find the sum of several fractions of different denominations or integers ?

A. Find the value of each fraction, separately, in the known of the integer, then add the several quantities together, compound addition, and you will have the amount of the ones, as before.

SUBTRACTION OF VULGAR FRACTIONS. 179

EXAMPLES.

1 Add $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{1}{4}$ of $\frac{1}{5}$ together. Operation. $\frac{1}{4}$ of $\frac{1}{5} = \frac{1}{20}$
 $= \frac{1}{20}$; the fraction will then stand $\frac{1}{2}$, $\frac{2}{3}$, $\frac{1}{5}$, $\frac{1}{20}$, which being reduced to a common denominator, will stand as follows, viz.:
 $\frac{13}{270}$, $\frac{180}{270}$, $\frac{162}{270}$, $\frac{30}{270}$.

Then $135 + 180 + 162 + 30 = 507$ the sum of the numerators.

270 the common denominator.

Then $507 \div 270 = 1\frac{23}{90}$. *Ans.*

2. What is the sum of $\frac{5}{6}$, $3\frac{2}{3}$, $\frac{1}{2}$ of $\frac{1}{4}$? *Ans.* $4\frac{29}{36}$.

3. Add together $\frac{1}{2}$ of a foot, $\frac{1}{4}$ of a yard, $\frac{1}{8}$ of a rod, $\frac{1}{5}$ of a furlong, and $\frac{1}{6}$ of a mile.

Ans. $\frac{6919}{7200}$, equal to 8. fur. 8 rods, 1 yd. 1 ft. 9 in. $2\frac{1}{4}$ bar.

4. What is the sum of $\frac{5}{7}$ of an eagle, $\frac{3}{8}$ of dollar, and $1\frac{1}{2}$ cents, added together? *Ans.* \$7.53 cts. $2\frac{1}{2}$ mills.

5. A man bought $\frac{1}{3}$ of a manufacturing establishment, and soon after he purchased $\frac{1}{4}$ more; afterwards he bought $\frac{1}{5}$ of $\frac{1}{3}$; another person who owned $\frac{1}{6}$ of the whole, wishing to sell, he also purchased his share; what proportion of the whole establishment did he then own? *Ans.* $\frac{13}{12}$.

6. A man bought 4 pieces of land, the first contained $2\frac{3}{4}$ acres, the second $3\frac{1}{2}$ acres, the third $4\frac{9}{10}$ acres, and the fourth $5\frac{1}{5}$ acres; how many acres did he buy?

Ans. 17 a. 0 r. $13\frac{1}{2}$ rods.

7. A man hired 4 men to mow a large meadow, containing 36 acres; the first man mowed $\frac{1}{2}$ of $\frac{1}{3}$ of the whole; the second mowed $\frac{1}{3}$ of $\frac{1}{4}$ of the whole; the third mowed $\frac{1}{4}$ of $\frac{1}{5}$ of the whole; and the fourth mowed $\frac{1}{5}$ of $\frac{1}{6}$ of $\frac{1}{7}$ of the whole; I wish to know how many acres each man mowed, and how many acres (if any) were left unmowed? *Ans.* The 1st man mowed 6 acres; the 2d man 8; the 3d man 15; the 4th man 7; the whole was therefore mowed, being 36 acres.

8. Add together $\frac{1}{2}$ of a week, $\frac{1}{3}$ of a day, $\frac{1}{4}$ of an hour, $\frac{1}{5}$ of a minute, and $\frac{1}{6}$ of a second. *Ans.* $\frac{175311}{337800}$, 2 d. 6 h. 45 m. $12\frac{1}{2}$ s.

9. What is the amount of $\frac{1}{3}$ of a dollar, $\frac{1}{4}$ of a cent, $\frac{1}{5}$ of a cent, and $\frac{1}{6}$ of mill? *Ans.* 20 cents, 9 mills.

10. Add together $30\frac{19}{23}$, $46\frac{23}{23}$, $9\frac{6}{23}$, and $16\frac{14}{23}$. *Ans.* $103\frac{19}{23}$ or $\frac{2371}{23}$.

SUBTRACTION OF VULGAR FRACTIONS.

Q. What is the RULE for subtraction of Vulgar Fractions?

A. Prepare the fractions, exactly as you prepare them for addition; then the difference of the numerators, written over the common denominator, will form the fraction required.

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Q. How can you subtract one mixed number from another?

A. If the numerator of the lower fraction, or subtrahend, be less than the numerator of the upper one, or minuend, subtract the lower numerator from the upper, and write the difference over the common denominator; then subtract the whole number as usual.

Q. When the lower fraction is greater than the upper one, how do you proceed?

A. Subtract the lower numerator from the common denominator, and add this difference to the upper numerator, and write the sum over the denominator, for the fraction, and always remember to carry one to the unit figure of the whole number, in the subtrahend, and proceed to subtract as usual.

Q. When the minuend has a fraction, and the subtrahend has none, how do you proceed?

A. Bring down the fraction of the minuend, to the right hand, and proceed to subtract, as if there had been no fraction.

Q. When the subtrahend has a fraction, and the minuend has none, how do you proceed?

A. Subtract the numerator from the denominator, and write the difference over the denominator, for the fraction, and always remember to carry one to the first figure of the whole number in the subtrahend, and proceed as in whole numbers.

EXAMPLES.

1. From $46\frac{7}{12}$ Take $39\frac{3}{12}$	2. From $134\frac{3}{8}$ Take $75\frac{5}{8}$	3. From $321\frac{5}{16}$ Take $147\frac{7}{16}$	4. From $946\frac{33}{48}$ Take $387\frac{15}{48}$
5. From $191\frac{15}{16}$ Take 87	6. From 346 Take $187\frac{13}{32}$	7. From $247\frac{14}{32}$ Take $149\frac{13}{32}$	8. From $910\frac{61}{112}$ Take $198\frac{31}{112}$

- From $100\frac{7}{12}$, take $87\frac{3}{12}$, how much remains? *Ans.* $13\frac{4}{12}$.
- From $97\frac{3}{8}$, take $49\frac{5}{8}$, how much remains? *Ans.* $47\frac{3}{8}$.
- From $57\frac{1}{4}$, take 28 , how much remains? *Ans.* $29\frac{1}{4}$.
- From 19 , take $2\frac{1}{4}$, how much remains? *Ans.* $16\frac{3}{4}$.
- From 4 , take $3\frac{7}{8}$, how much remains? *Ans.* $3\frac{1}{8}$.
- If I purchase $\frac{1}{4}$ of a factory, and sell $\frac{3}{8}$ of my share, what proportion of the whole factory do I sell, and what proportion do I still own?
Ans. { I sell $\frac{1}{4}$ or $\frac{2}{8}$ of the whole.
 { I still own $\frac{1}{8}$ of the whole.
- I buy $\frac{1}{4}$ of a ship, and sell $\frac{3}{8}$ of my share, what proportion do I still own? *Ans.* $\frac{1}{8}$ of the whole.

15. A man who owned $\frac{1}{3}$ of a manufacturing establishment, agreed to sell $\frac{1}{3}$ of the whole factory to A.; soon after he sold $\frac{1}{4}$ of $\frac{2}{3}$ of the whole, to B.; and to C. he sold $\frac{1}{4}$ of the whole; and D. wishing to purchase the residue of his share, he wants to know what proportion of the establishment he can sell him.

Ans. He can sell him $\frac{1}{6}$.

16. From $\frac{7}{8}$ of $\frac{4}{5}$ of 5 dollars, take $\frac{2}{5}$ of 96 cents, added to $\frac{1}{3}$ of \$1 $\frac{1}{2}$.

Ans. 96 cents, 9 $\frac{1}{2}$ mills.

17. From £ $\frac{1}{2}$, take $\frac{9}{10}$ of a shilling.

Ans. 4s. 1 $\frac{1}{2}$ d.

18. A man built a factory which cost him 35,000 dollars, and sold to A. $\frac{9}{10}$ of the whole; soon after, he sold to B. $\frac{2}{5}$ of the whole establishment; A. also sold to C. $\frac{1}{4}$ of his share; and B. sold to D. $\frac{2}{3}$ of his share; I wish to know what proportion of the establishment each man now owns, and how much each man's present share cost him, allowing each to purchase at the original cost? *Ans.* The builder still owns $\frac{3}{10}$ of the whole, at the cost of \$1312,50 cts; A. still owns $\frac{1}{5}$, at the cost of \$13125; B. owns $\frac{1}{4}$, at a cost \$8750; C. owns $\frac{3}{10}$, at a cost of \$6562,50, and D. owns $\frac{2}{5}$, at a cost of \$5250.

19. A gentleman bought at one time, $\frac{2}{3}$ of a township of land, ten miles square, and soon after he bought $\frac{1}{3}$ of the residue, and at the third purchase, he bought the remaining portion; I wish to know what part of the whole he bought at each purchase, and how many acres each purchase contained? *Ans.* His first purchase, $\frac{2}{3}$, contained 24,000 acres; his second purchase, $\frac{2}{4}$, contained 25,000 acres; his third purchase, $\frac{1}{4}$, contained 15,000 acres.

MULTIPLICATION OF VULGAR FRACTIONS.

Q. Will any number be increased or diminished by being multiplied by a vulgar fraction?

A. It will be diminished in the same proportion as the multiplier is less than an unit or 1.

Q. How can you demonstrate, that multiplying by a fraction decreases the number multiplied?

A. By the self-evident fact that the greater the multiplier is, the greater will be the product; and of course, the smaller the multiplier, the less will be the product. Thus, $8 \times 4 = 32$. Now if the multiplier, 4, be reduced one half, or to 2, then $8 \times 2 = 16$, which is one half what it was, when multiplied by 4. Now let this last multiplier, 2, be again reduced one half, which will make 1, then $8 \times 1 = 8$, just one half what it was, when multiplied by 2. Again, if this last multiplier, 1, be still reduced one half, which will leave it $\frac{1}{2}$, it must be evident that

the product arising from it, must be only one half what it was when multiplied by 1. Thus, $8 \times \frac{1}{2} = 4$, and so on, in proportion as the multiplier is less than 1.

CASE, FIRST.

Q. What is the first case in Multiplication of Fractions?

A. To multiply a whole number by a fraction, or a fraction by a whole number.

Q. What is the RULE in this case?

A. If the numerator of the fraction be one, as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, &c. divide the whole number by the denominator of the given fraction, and the quotient, thence arising, will be the proper product or answer.

Q. When the numerator of the fraction is more than 1, as $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, &c. how do you multiply by it?

A. Multiply the whole number by the numerator of the given fraction, and divide this product by the denominator, and the quotient will be the product or answer.

Q. When it is required to multiply a whole number by a compound fraction, how do you proceed?

A. Reduce the compound fraction to a simple one, and this fraction to its lowest term, then proceed to multiply as before directed.

EXAMPLES.

1. Multiply 144 by $\frac{1}{3}$. 2. Multiply 96 by $\frac{1}{8}$. 3. Multiply 136 by $\frac{1}{4}$.
Operations and answers.

$144 \div 3 = 48$ Ans. $96 \div 8 = 12$ Ans. $136 \div 4 = 34$ Ans.

4. Multiply 224 by $\frac{3}{8}$. 5. Multiply 144 by $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{1}{4}$.
 $\times 3$ $1 \times 2 \times 3 = 6$

8)672 Operation. $\frac{2 \times 3 \times 4 = 24}{24} = \frac{1}{4}$ multiplier.

Then $144 \div 4 = 36$ Ans.

Ans. 84

6. What cost 136 yards of cloth, at $\frac{3}{8}$ of a dollar a yard?

Ans. \$51.

7. What cost 75 pounds of coffee, at $\frac{3}{16}$ of a dollar per lb.?

Ans. \$14 $\frac{1}{4}$.

8. What cost 138 yards of cloth, at $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{1}{4}$ of a dollar per yard?

Ans. \$45,281 m +

9. If a ship cost 15460 dollars, what is $\frac{3}{8}$ of her worth?

Ans. \$9662,50 cts.

10. If I buy $\frac{9}{12}$ of a ship, which cost 18000 dollars, and sell $\frac{1}{2}$ of my share to A., and A. sells $\frac{1}{3}$ of his share to B., and B. sells $\frac{2}{5}$ of his share to C., what does C. pay for his share, and what proportion of the ship does each now own?

Ans. { I own $\frac{3}{8}$ of the ship. A. owns $\frac{1}{4}$ of it. B. owns $\frac{3}{16}$.
C. owns $\frac{1}{20}$ at the cost of \$900.

11. What cost 4 quarter casks of wine, each containing $31\frac{1}{2}$ gallons, at $\frac{2}{3}$ of a dollar per gallon? *Ans.* \$78 $\frac{1}{3}$.

CASE SECOND.

Q. What is the second case in Multiplication of Vulgar Fractions?

A. To multiply a whole number by a mixed one, or a mixed number by a whole one.

Q. What is the RULE in this case?

A. Multiply by the fraction as in case first; then multiply by the whole number as usual, and add the two products together for the answer; or, if the multiplicand be a mixed number, multiply the whole numbers together as before, then multiply the given multiplier by the fraction of the multiplicand, and add the products together as before, for the answer.

EXAMPLES.

1. What must be given for 137 yards of cloth, at \$5 $\frac{1}{2}$ per yard? *Ans.* \$702,12 $\frac{1}{2}$.

2. What is the weight of 7 loads of hay, each weighing 24 $\frac{1}{2}$ cwt.? *Ans.* 171 $\frac{1}{2}$ cwt.

3. What must I give for 4 lots of land, each containing 24 $\frac{1}{2}$ acres, at the rate of 13 dollars an acre? *Ans.* \$1283,75.

4. Seven children, after dividing their father's farm equally among them, found they had 75 acres, and $\frac{1}{3}$ of $\frac{2}{3}$ of $\frac{4}{5}$ of $\frac{3}{4}$ of an acre, each; how many acres did the whole farm contain?

Ans. 526 ac. 1 rood, 37 $\frac{1}{4}$ rods.

5. Six men drew a prize, which being divided among them, each had 46 and $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{2}{5}$ dollars; what was the whole prize?

Ans. \$277,96 $\frac{2}{5}$ cts.

6. What is the product of 378 multiplied by 1 $\frac{3}{4}$? *Ans.* 661 $\frac{1}{2}$.

7. What is the product of 576 multiplied by 1 and $\frac{1}{3}$ of $\frac{2}{3}$ of $\frac{9}{16}$? *Ans.* \$802 $\frac{1}{2}$.

8. What is the product of 47 and $\frac{3}{4}$ of $\frac{1}{5}$ of $\frac{2}{3}$, multiplied by 28? *Ans.* 1317 $\frac{1}{3}$.

9. Multiply $\frac{4}{5}$ of $\frac{2}{3}$ of $\frac{4}{12}$ of $\frac{7}{16}$, by 5. *Ans.*

CASE THIRD.

Q. What is the third case in multiplication of fractions ?

A. To multiply a mixed number, by a mixed number.

Q. What is the RULE in this case ?

A. Reduce each term to an improper fraction, and multiply the two numerators together, and make their product a dividend; then multiply the two denominators together, and make their product a divisor; divide, and the quotient will be the proper product.

EXAMPLES.

1. Multiply $36\frac{1}{2}$, by $12\frac{3}{5}$.

Operation. $36\frac{1}{2}$ $12\frac{3}{5}$
 $\begin{array}{r} 36\frac{1}{2} \\ \times 12\frac{3}{5} \\ \hline 110 \quad 63 \end{array}$
 Then $110 \times 63 \div 3 \times 5 = 462$
Ans. 462 product.

2. Multiply $87\frac{1}{2}$, by $1\frac{1}{2}$ of $\frac{2}{5}$.

Operation. $87\frac{1}{2}$ $2 \times 3 = 6 \quad 2$
 $\begin{array}{r} 87\frac{1}{2} \\ \times 1\frac{1}{2} \\ \hline 175 \end{array}$ $\begin{array}{r} 2 \times 3 = 6 \quad 2 \\ 3 \times 5 = 15 \quad 5 \\ \hline 1\frac{1}{2} \end{array}$
 Then $1\frac{1}{2}$
 $\begin{array}{r} 5 \\ 7 \\ \hline 5 \end{array}$
 Then $157 \times 7 \div 5 \times 2 = 122\frac{1}{2}$ *Ans.*

3. How many square feet, in a room $16\frac{1}{2}$ feet long, and $9\frac{1}{2}$ feet in width ? *Ans.* $162\frac{1}{2}$ feet.

4. How many square yards, in a garden $37\frac{1}{2}$ yards square ?
Ans. 1415 yards, 5 feet, $110\frac{1}{2}$ inches.

5. What is the product of $\$25\frac{1}{2}$, multiplied by $\$37\frac{1}{2}$?
Ans. $\$950,03\frac{1}{2}$.

6. How many square miles, in a town $12\frac{3}{5}$ miles in length, and $9\frac{1}{2}$ miles in breadth ? *Ans.* 124 sq. miles, and 272 sq. a.

7. A man bought $45\frac{3}{5}$ acres of land, at $\$37\frac{1}{2}$ per acre, and sold $26\frac{1}{2}$ acres, at $\$29\frac{1}{2}$ per acre, and the residue he sold at $\$48\frac{1}{2}$ per acre ; did he gain or lose, and how much ?

Ans. He lost $\$2,871\frac{1}{2}$ m.

CASE FOURTH.

Q. What is the general RULE for the multiplication of fractions, whether proper, improper, compound, or mixed ?

A. Reduce compound fractions to simple ones, mixed numbers to improper fractions, and those of different integers to those of the same ; then multiply all the numerators together, for a new numerator, and all the denominators together, for a denominator.

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N. B.—When several fractions are to be multiplied, if the numerators of any of them are equal to any of the denominators, those equal numerators and denominators may be omitted, and thus the operation will be shortened, and the result will be the same.

EXAMPLES.

1. What is the product of $4\frac{1}{2}$, $\frac{3}{4}$ of $\frac{5}{8}$, and $\frac{2}{3}$ of $\frac{5}{8}$ of 9, multiplied together?

	1st		2d		3d fraction.
	1	9,	3×	5	15
				5.	2×
Operation.	4=		—of=	or—	—of=
	2	2.	4×	6	24
				8.	3×
					8×
					1
					24
					4

The fractions, being reduced, stand, $\frac{9}{2}$, $\frac{5}{8}$, and $\frac{1}{4}$ to be multiplied.

Therefore, $9 \times 5 \times 15 = 675$
 $2 \times 8 \times 4 = 64$
 Then $675 \div 64 = 10\frac{35}{64}$ Ans.

2. What is the product of $\frac{3}{4}$ of $\frac{5}{8}$ of $7\frac{1}{2}$, multiplied by $\frac{5}{8}$ of $\frac{3}{4}$ of $9\frac{1}{2}$?
 Ans. $20\frac{65}{128}$.

3. Multiply $\frac{4}{5}$ of $\frac{3}{4}$ of $\frac{2}{3}$, by $\frac{3}{4}$ of $\frac{5}{8}$ of $\frac{1}{4}$.
 Ans. $\frac{1}{4}$.

4. If I purchase 40 acres of land, and sell $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{5}{8}$ of it, how many acres have I left?
 Ans. $30\frac{3}{8}$ acres.

5. What is the product of $\frac{3}{4}$ of $\frac{5}{8}$ of $\frac{7}{8}$ of 24, multiplied by $\frac{4}{5}$ of $\frac{6}{8}$ of $\frac{9}{8}$ of 14; what is the sum and difference of the two factors? Ans. The product is 98, the sum $20\frac{71}{20}$, and the difference is $5\frac{79}{120}$.

DIVISION OF VULGAR FRACTIONS.

Q. Will any number be increased or diminished by being divided by a fraction?

A. It will be increased in the same proportion, as the divisor is less than an unit or 1.

Q. How can you illustrate the fact, that any number will be increased by being divided by a fraction?

A. By the self-evident proposition, that the larger the divisor, the smaller will be the quotient; and of course, the smaller the divisor, the larger will be the quotient; thus, $12 \div 4 = 3$. Now if this divisor 4, be reduced one half, or to 2, then $12 \div 2 = 6$, which is just double that of 12, divided by 4. Now let the divisor again be reduced one half, or to 1, then $12 \div 1 = 12$, which is, again, just double the former quotient; again, last divisor be still reduced one half, it will be $\frac{1}{2}$, and it must be evident, that the quotient, thence ar-

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be just double that which was produced by dividing by 1. Thus, $12 \div \frac{1}{2} = 24$, and so on, in proportion as the divisor is less than an unit or 1.

CASE FIRST.

Q. What is the first case in Division of Fractions ?

A. To divide a whole number by a simple fraction.

Q. What is the RULE in this case ?

A. If the numerator of the divisor be 1, as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, &c. multiply the dividend by the denominator of the divisor, and the product thence arising will be the proper quotient or answer.

Q. If the numerator of the fraction be more than 1, as $\frac{3}{4}$, $\frac{5}{6}$, &c. how do you divide by it ?

A. Multiply the dividend, by the denominator of the divisor, as before, then divide this product by the numerator of the divisor, and the quotient will be the answer.

Q. If the divisor be a compound fraction, how do you divide by it ?

A. First, reduce the compound fraction to a simple one, and this fraction to its lowest term, then multiply by the denominator, and divide by the numerator, as before directed, and the quotient will be the answer.

EXAMPLES.

1.
Divide 627 by $\frac{1}{4}$.
Operation. 627
 $\times 4$

3)2508

836 *Ans.*

2.
Divide 836 by $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{4}$.
Operation. $\frac{1}{2} \times \frac{1}{3} \times \frac{1}{4} = \frac{1}{24}$ divisor.
Then $836 \times 24 \div 15 = 3566\frac{1}{3}$
Therefore $3566\frac{1}{3}$ *Ans.*

3. What is the quotient of 51, divided by $\frac{1}{3}$? *Ans.* 136.
4. What is the quotient of 4284, divided by $\frac{1}{4}$? *Ans.* 4896.
5. Divide 100 by $\frac{3}{10}$, and find the quotient. *Ans.* 333 $\frac{1}{3}$.
6. What is the quotient of 97, divided by $\frac{7}{12}$? *Ans.* 166 $\frac{2}{3}$.
7. What is the quotient of 136, divided by $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{4}$? *Ans.* 2856.
8. If $\frac{2}{3}$ of a vessel cost 1325 dollars, what cost the whole ?
Ans. \$3312,50 cents.
9. If I sell to A. $\frac{1}{2}$ of my farm, and A. sells to B. $\frac{2}{3}$ of his share, and B. again sells to C. $\frac{1}{3}$ of his share, for 1450 dollars, what would the whole farm be worth, if estimated at the same price ?
Ans. \$36,250.

10. If $\frac{1}{3}$ of $\frac{3}{5}$ of a manufacturing establishment cost 9375 dollars, what is the whole worth, at that rate? *Ans.* \$46,875.

11. A merchant purchased 375 bushels of salt, which constituted $\frac{1}{2}$ of $\frac{3}{5}$ of $\frac{5}{8}$ of the whole cargo; how many bushels did the cargo contain? *Ans.* 2000.

12. What number is that, which being multiplied by $\frac{1}{4}$ of $\frac{5}{8}$ of $\frac{1}{2}$, will be 25? *Ans.* 80.

CASE SECOND.

Q. What is the second case in Division of Fractions?

A. When the divisor is a mixed number.

Q. What is the RULE in this case?

A. Multiply the whole number of the divisor, by the denominator of the fraction, and add in the numerator for a new divisor; then multiply the dividend by the same denominator for a new dividend, divide, and the quotient will be the answer.

EXAMPLES.

1. Divide 216 by $4\frac{3}{5}$. Operation $4 \times 5 + 3 = 23$ new divisor. Then $216 \times 5 = 1080$ new dividend. Then $1080 \div 23 = 46\frac{22}{23}$ *Ans.*

2. What is the quotient of 129 divided by $7\frac{2}{3}$? *Ans.* $16\frac{23}{3}$.

3. What is the quotient of 642 divided by $21\frac{9}{10}$? *Ans.* $29\frac{143}{10}$.

4. In 587 gallons of wine, how many quarter casks, each containing $31\frac{1}{2}$ gallons? *Ans.* $18\frac{40}{83}$ or 20 gallons.

5. How many sheep can I buy for 136 dollars, at $\$3\frac{5}{8}$ per head? *Ans.* $37\frac{15}{8}$, or \$1,87 $\frac{1}{2}$ left.

6. How many garments, each containing $4\frac{2}{7}$ yards, can be made from a bale of cloth, containing 12 pieces, each piece containing $36\frac{1}{4}$ yards? *Ans.* $101\frac{1}{2}$.

7. A man has 10,000 dollars, which he wishes to invest in bank stock, at $54\frac{3}{8}$ dollars a share; how many shares can he buy? *Ans.* $183\frac{7}{8}$ shares, or 183 shares, and \$49 $\frac{3}{8}$ left.

CASE THIRD.

Q. What is the third case in Division of Fractions?

A. It is when the dividend is a mixed number, and the divisor a whole number.

Q. What is the RULE in this case?

A. Multiply the whole number of the dividend by the denominator of its own fraction, and add in the numerator, for a new dividend; then multiply the divisor by the denominator, for a new divisor, divide, and the quotient will be the answer.

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EXAMPLES.

1. What is the quotient of $666\frac{2}{3}$ divided by 6 ?
 Operation. $666 \times 3 + 2 = 2000$ the new dividend.
 $6 \times 3 = 18$ the new divisor.
 Then $2000 \div 18 = 111\frac{2}{9}$, or $\frac{1}{9}$, the *Ans.*
2. Divide $1375\frac{5}{8}$, by 46. *Ans.* $29\frac{253}{468}$.
3. Divide $987\frac{2}{3}$, by 24. *Ans.* $41\frac{5}{36}$.
4. Divide $763\frac{5}{12}$, by 16. *Ans.* $47\frac{137}{192}$.
5. Divide $894\frac{1}{3}$, by 18. *Ans.* $49\frac{23}{54}$.
6. Divide $3763\frac{11}{12}$, by 8. *Ans.* $470\frac{7}{24}$.
7. If $48\frac{1}{4}$ acres of land be divided among 16 persons, how much will each one have ? *Ans.* $3\frac{1}{16}$ acres.
8. What number, being multiplied by 9, will produce $349\frac{4}{11}$?
Ans. $38\frac{17}{33}$.
9. What number, multiplied by 14, will produce $237\frac{5}{7}$?
Ans. $16\frac{11}{14}$.

CASE FOURTH.

- Q.** What is the fourth case in Division of Fractions ?
A. It is to divide fractions of all kinds, whether they be proper, improper, single, compound, or mixed.
- Q.** What is the general RULE for Division of Fractions ?
A. Reduce compound fractions to simple ones, mixed numbers to improper fractions, and those of different integers to those of the same ; then invert the divisor, and proceed exactly as in multiplication ; and the product of all the fractions will be the proper quotient or answer.

EXAMPLES.

1. Divide $\frac{1}{2}$ of $\frac{4}{5}$ of 24, by $\frac{1}{3}$ of $\frac{1}{4}$ of 9.
 Operation. $\frac{1}{2} \times \frac{4}{5} \times 24 = \frac{96}{5}$ or $32\frac{2}{5}$ the dividend.
 Then $\frac{1}{3} \times \frac{1}{4} \times 9 = \frac{3}{4}$ the divisor.
 The divisor, inverted, will stand, $\frac{4}{3} \times \frac{3}{4} = \frac{356}{3}$.
 And $256 \div 135 = 1\frac{121}{135}$ *Ans.*
 2. What is the quotient of $\frac{1}{20}$ divided by $\frac{9}{16}$?
Ans. $\frac{190}{90}$ or $1\frac{1}{9}$.
 3. What is the quotient of $\frac{2}{3}$ of 17, divided by $\frac{1}{4}$ of 9 ?
Ans. $1\frac{22}{9}$.
- What is the result of $9\frac{1}{2} + 8\frac{1}{2} - 11\frac{1}{2} \times 6\frac{1}{2} \div 12\frac{1}{2}$? *Ans.* $3\frac{53}{100}$.
- What is the quotient of $\frac{2}{3}$ of $\frac{1}{2}$ of 19, divided by $\frac{1}{4}$ of $\frac{1}{2}$?
Ans. $\frac{51}{10}$.

6. What is the quotient of $\frac{3}{5}$ of $\frac{5}{8}$, of 8, divided by $\frac{1}{2}$ of $\frac{7}{8}$ of 6, and that product divided by $\frac{1}{6}$ of 13? *Ans.* $\frac{99}{637}$.

7. What will be the result of $\frac{1}{2}$, $\frac{3}{8}$, $\frac{3}{4}$, $\frac{5}{8}$ and $\frac{6}{7}$, added together, and $\frac{1}{8}$, $\frac{2}{6}$, $\frac{3}{10}$, and $\frac{4}{11}$, subtracted from the sum, and this difference multiplied by $\frac{2}{5}$ of $\frac{3}{7}$ of 14, and the product divided by $\frac{3}{4}$ of $\frac{1}{2}$ of 9? *Ans.* The sum is $\frac{191}{28}$; the difference $\frac{71969}{27720}$; the product $\frac{71969}{11550}$; and the quotient $\frac{1131951}{138023}$.

DECIMAL FRACTIONS.

Q. What is a Decimal Fraction?

A. It is a fraction, whose value can be increased or diminished only in a tenfold degree.

Q. How is the integer divided in a decimal fraction?

A. It is always divided into 10, 100, 1000, 10000, &c. equal parts.

Q. What, then, will always be the denominator of a decimal fraction?

A. It will always be an unit or 1, with as many ciphers annexed, as there are figures in the decimal expression.

Q. From what do decimal fractions arise, and how are they produced?

A. They, like all fractions, arise from division; when any number is divided, and there is a remainder, this remainder being multiplied by 10, 100, 1000, &c. and divided by the original divisor, produces a decimal fraction for the quotient, and may be continued so long as there is a remainder, or until it is carried to a sufficient degree of exactness.

Q. How are decimal fractions expressed, or written?

A. The numerator, alone, is written down, with a point or comma, called a separatrix, placed at the left hand, to distinguish it from a whole number; thus, .5, .05, .253, which are meant to express $\frac{5}{10}$, $\frac{5}{100}$, $\frac{253}{1000}$, &c.

Q. At which hand do you begin to numerate fractions?

A. At the left hand.

Q. What is the relative value of the decimal figures, as they are numerated from the left to the right?

A. The first figure, at the right hand of the separatrix is tenths, the second is hundredths, the third is thousandths, &c. increasing in name in a tenfold proportion, but decreasing in value in the same proportion, as will be seen from the following table.

DECIMAL FRACTIONS.

NUMERATION TABLE.

Whole Nos.	5	100s	of millions.
	4	10s	of millions.
	3		millions.
	2	100s	of thousands.
	1	10s	of thousands.
	2	thousands.	
	3	hundreds.	
	4	tens.	
	5,	units.	
	5	tenth parts.	
	4	hundredths.	
	3	thousandths.	
	2	10s	of 1000ths.
	1	100s	of 1000ths.
	2		millionths.
	3	10s	of millionths.
	4	100s	of millionths.
	5	1000s	of millionths.
			dec.

Q. If the numerator has not so many figures, as the denominator has ciphers, how must it be written ?

A. The deficiency must be supplied by prefixing ciphers, or placing them at the left hand.

Q. How are decimals affected by having ciphers placed at the left hand?

A. Every cipher, placed at the left hand of a decimal, decreases it in a tenfold proportion.

Q. Why are they decreased by having ciphers placed at the left hand?

A. Because every cipher, placed at the left hand of the numerator, removes the significant figures one place further from the separatrix; and as the denominator is thus increased, by every such removal, in a tenfold degree, of course, every cipher prefixed to the numerator, makes the fraction tentimes less than before; thus, $5 = \frac{5}{1}$, but $.05$ is equal only to $\frac{5}{100}$, and $.005$ is only $\frac{5}{1000}$, &c.

Q. How are decimals affected by having ciphers placed at the right hand?

A. Ciphers, at the right hand of decimals, do not alter their value, because, although the numerator be increased by them, the denominator is also increased in the same degree, and will bear the same proportion to it, as before; thus, $\frac{5}{10}$ or $\frac{50}{100}$, $\frac{500}{1000}$, are all of the same value, each being equal to $\frac{1}{2}$ or $\frac{1}{2}$.

Q. Does the value of a decimal depend on the number of figures in the decimal expression?

A. It does not; that decimal is greatest, whose first or left hand figure is greatest, whether it consist of a greater or less number of figures; thus, .5 is more than .475.

Q. How can you illustrate, that, 5 is of more value than, 475?

,5 be reduced to the same denominator as .475, it
00, and their values will then appear to be $\frac{475}{1000}$ and
ch shows, that the integer, being divided into 1000

parts, $\frac{5}{10}$ or $\frac{5}{100}$ contains 25 more of those parts than are contained in $\frac{475}{1000}$.

Q. How are decimals reduced to a common denominator?

A. Annex so many ciphers to those that have fewer places, as will make them equal to those that have most, and they will all have the same denominator; thus, $\frac{6}{10}$, $\frac{25}{100}$, $\frac{125}{1000}$, and $\frac{3756}{10000}$, may be reduced to the following decimals, viz.: $\frac{6000}{10000}$, $\frac{2500}{10000}$, $\frac{1250}{10000}$, $\frac{3756}{10000}$, each of which has 10,000 for a common denominator.

Q. How are decimals reduced to their lowest terms?

A. By cutting off all the ciphers at the right hand, if there be any; those decimals, having no ciphers at the right hand, being already in their least terms.

ADDITION OF DECIMALS.

Q. What is the RULE for Addition of Decimals?

A. Place the numbers, whether mixed or pure decimals, under each other, according to their value, that is, tenths under tenths, hundredths under hundredths, &c. without regard to the number of figures in the several decimal expressions; then add them together in the order as they stand, as in simple addition, and point off as many places for decimals in the sum total, as are equal to the greatest number of decimal places in any of the given numbers.

EXAMPLES.

$$\begin{array}{r} 1. \\ \text{Add } 375,95 \\ 186,035 \\ 571,4 \\ 187,0075 \\ \hline \end{array}$$

$$\begin{array}{r} 2. \\ \text{Add } 93,5 \\ 39,05 \\ 78,005 \\ 47,91 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \\ \text{Add } 756 \\ ,8353 \\ ,26894 \\ ,87 \\ \hline \end{array}$$

4. What is the sum of the following numbers, viz.: $146,375 + 95,75 + 237,5 + 3750,0856$, and $87,5$? *Ans.* 4317,2106.

5. Find the sum of $19,073 + 2,3597 + 0,0197581 + 223 + 3478,1$, and $12,358$. *Ans.* 3734,9104581.

6. What is the sum of $27 + 14,49 + 126 + 9,99 + 469$, and $,2614$. *Ans.* 52,3364.

7. What is the sum of $,15 + 100,67 + 1,5 + 33 + 467$, and $24,6$? *Ans.* 160,387.

8. Add $99,99 + 31 + 25 + 60,102 + 29$, and $100,347$ cr. *Ans.* 4

9. What is the amount of $4,25 + 5,075$, and $7,0$

SUBTRACTION OF DECIMALS.

Q. What is the **RULE** for Subtraction of Decimals?

A. Place the numbers according to their value, as in addition, and subtract exactly as in whole numbers, and point off the decimals as you pointed them off in addition.

EXAMPLES.

1.
From 871,86
Take 498,875

2.
From 146,751
Take 18,0578

3.
From 9,008
Take 5,0098

4.
From 946,
Take 9,785

5.
From 46,5
29,759

6.
From 123,4567
76,54

7. If ,987654 be subtracted from 100, how much will remain? *Ans.* 99,012346.

8. Add 75,867 and 24,133932 together, and from their sum subtract 46,578398, and how much remains? *Ans.* 53,422534.

9. If from 375,5 you subtract 187,75, and to the difference add 98,1275, and from this sum subtract 125,9876543, how much must be added to this last remainder, to make the sum just 500? *Ans.* 340,1101543.

10. What is the result of $465,75 + 125,5 - 387,25 + 750,1234 - 598,987654 + ,8735 - ,987654321$? *Ans.* 355,021591679.

MULTIPLICATION OF DECIMALS:

Q. How are Decimals multiplied?

A. They are multiplied precisely like whole numbers.

Q. Will any number be increased or diminished by being multiplied by a decimal or any other fraction?

A. It will be diminished in the same proportion as the multiplier is less than an unit or 1.

Q. How can you prove this?

A. By the fact, that the less the multiplier, the less must be the product.

Q. What then will be the product of an unit or 1, multiplied by ,5?

A. ,5 or $\frac{1}{2}$.

multiplied into itself, what will the product be?
,25 or $\frac{1}{4}$.

Q. What will be the product of .25 multiplied into itself?

A. It will be .0625 or $\frac{1}{16}$.

Q. What will be the effect of multiplying cents into themselves?

A. As cents are, in every respect, decimals of a dollar, the same effect is produced by their multiplication, as is produced by the same operation in decimals.

Q. What will be the product, if dollars are multiplied by any of the smaller denominations of federal money?

A. Dollars, multiplied by dimes, produce dimes; dollars, multiplied by cents, produce cents; dollars, multiplied by mills, produce mills.

Q. What will be the product of the smaller denominations, as dimes, cents, and mills, being multiplied together?

A. Dimes, multiplied by dimes, produce cents; dimes, multiplied by cents, produce mills; dimes, multiplied by mills, produce 10th of mills; cents, multiplied by cents, produce 10th of mills; cents, multiplied by mills, produce 100th of mills; mills, multiplied by mills, produce 1000th of mills.

Q. What fundamental principle, or law of multiplication are you taught, by the foregoing theory?

A. From the foregoing explanations, it is evident, that any two numbers, (whether one or both are fractions,) being multiplied together, will always produce a product, whose value will be as many grades below the least term multiplied, as the largest term is below an integer or 1.

Q. What is the RULE for Multiplication of Decimals?

A. Place the multiplier under the multiplicand as usual, without regard to the decimal places, multiply them as in whole numbers, and point off as many figures from the right hand of the product for decimals, as there are decimal places in both the factors, counted together.

Q. If there are not so many figures in the product, as there are decimals in both the factors, what is to be done?

A. Prefix ciphers to the product, till the number of figures is equal to the decimals in both factors, then place the separator before them, and you will have the true product.

EXAMPLES.

1.	2.	3.
Multiply 36,25	Multiply 75,5	437,468
By 4,05	By 5,25	75,000
Ans. 146,8125	Ans. 396,375	2
Q		

DIVISION OF DECIMALS.

Multiply $\begin{array}{r} 4. \\ 125 \\ \text{By } .06 \end{array}$

Ans. .00750

Multiply $\begin{array}{r} 5. \\ .75 \\ \text{By } .25 \end{array}$

Ans. .1875

Multiply $\begin{array}{r} 6. \\ .985 \\ \text{By } .006 \end{array}$

Ans. .005910

7. What is the product of .0063 multiplied by .0008 ?

Ans. .00000496.

8. What cost 375 bushels of oats, at .375 of a dollar a bushel ?

Ans. \$140.625.

9. Multiply nine hundredths by twenty-five thousandths.

Ans. .00225.

10. Multiply seventy-five thousandths, by one hundred and twenty-five ten thousandths.

Ans. .0009375.

11. Bought .6 of a ship, which was worth \$15675.75; what is my part worth ?

Ans. \$9405.45.

12. How much is .25 of .075 ?

Ans. .01875.

13. If you add six, and one hundred and thirty-five thousandths; and 9, and three hundred and seventy-five ten thousandths; and from their sum subtract 12, and nine hundredths; and multiply this remainder by 5,006; what will be the product ?

Ans. 15,430995.

14. What is the product of 125, and ninety-five thousandths, multiplied by 12, and five thousandths ?

Ans. 1501,765475.

15. A man bought .7 of a cotton factory, which cost the builders \$75275.75 cents; how much must he pay for his share ?

Ans. \$52693.025.

16. What is the result of $125.05 + .756 - 75.75 \times .006 + 496 - 287,1234 \times .0005 + 250,075 - 250,179588468$? Now, see if you can tell.

Ans. Nothing.

DIVISION OF DECIMALS.

Q. How are Decimals divided ?

A. They are divided exactly like whole numbers.

Q. Will any number be increased or diminished by being divided by a decimal fraction ?

A. It will be increased in the same proportion as the divisor is less than an integer or one.

Q. Why will any number be increased, by being divided by a decimal fraction ?

A. Because, the less the divisor is, the greater must always be the quotient; any number divided by 1, it is evident, will produce a quotient exactly equal to the dividend; therefore, if the divisor be less than 1, the quotient must, of course, be more than the dividend, and will always bear the same proportion to it, that an unit bears to the divisor.

Q. If 1, then, be divided by ,5, what will the quotient be ?

A. It will be 2.

Q. If 1, be divided by ,25, what will the quotient be ?

A. It will be 4.

Q. What is the general RULE for Division of Decimals ?

A. Divide as in whole numbers, and make your separatrix in the quotient, when you have divided as many decimal figures in the dividend, as there are decimals in the divisor ; the quotient, already found, will be a whole number, and all the figures, you afterwards get will be decimals. Or, point off the quotient in such a manner, that the decimals in the quotient and divisor, counted together, shall be equal to the decimal places in the dividend ; always remembering, that if the decimals in the divisor and dividend are equal, the quotient will be a whole number.

Q. If there are not so many figures in the quotient, as the rule requires for decimal places, what must be done ?

A. The deficiency must be supplied by prefixing ciphers to the quotient.

Q. If the dividend be, at first, too small to contain the divisor, what must you do ?

A. Annex ciphers to the dividend and divide as usual, as far as the nature of the question may require ; then point off the decimals in the quotient, as before directed.

Q. If the divisor be a whole number, and the dividend a mixed decimal, how is the quotient to be pointed off ?

A. Divide as usual, and make your separatrix in the quotient, when you have divided all the integers in the dividend ; or point off as many decimals in the quotient, as are pointed off in the dividend ; and, if there are not so many figures, supply the deficiency by prefixing ciphers.

Q. When the divisor is a mixed decimal, and the dividend is a whole number, how do you proceed ?

A. Annex as many ciphers to the dividend as there are decimal places in the divisor ; then divide as usual, and the quotient, thus far, will be a whole number. If there be a remainder, the process may be continued at pleasure, by annexing ciphers to the remainder, the quotient figures thence arising will be decimals.

Q. When the divisor is 10, 100, 1000, &c. how do you divide ?

A. Remove the separatrix in the dividend, as many figures towards the left hand, as there are ciphers in the divisor ; those figures at the left hand of the new separatrix will be whole numbers, and those at the right, will be decimals.

DIVISION OF DECIMALS.

EXAMPLES.

1. Divisor 12,35)48,8356(3,9542

3705

11785

11115

6706

6175

Annex a cipher 5310

4940

Annex another cipher 3700

2470

1230 Remainder.

2.

Divisor 125)71,875(.575.

625

937

875

625

625

3.

Divisor 6,16)42636(0,69

3696

5676

5680

132 Remainder.

4. What is the quotient of 224,38525, divided by 4,87?

Ans. 46,075.

Divisors.	Dividends.	Quotients.	Remainders.
5. .468	841,675	1798,45	40
6. 1,287	91,87654	71,388	184
7. 981,08	5768796	5880,046	47032
8. 8,008	123456,7	15416,67	664
9. ,009	,0123456	1,3717	3
10. 3,25	46,8734	14,4225	275

11. Thirteen men owned a lot of land, containing 473,876 acres; how much is each man's share, if equally divided, and how much will each share be worth, if sold at \$12,75 an acre?

Ans. 36,452 acres. Worth \$464,763.

12. If, 3 of a barrel of pork, be worth \$4,25, what will the whole barrel be worth?

Ans. \$14,166+.

13. I own, 6 of a ship, which cost me \$9405,45; how much is the whole ship worth, at that rate?

Ans. \$15675,75.

14. How much coffee, at .125 mills per pound, can I buy for \$175 ? *Ans.* 1400 pounds.

15. Add 128.09, and 9.128, together, from this sum take 114.0985, multiply the difference by .476, divide the product by 75.08, and what will be the quotient ? *Ans.* 0.14657.

REDUCTION OF DECIMALS.

Q. What are you taught by Reduction of Decimals ?

A. Reduction of Decimals teaches to bring vulgar fractions to decimals, and decimals to vulgar ; also, to reduce any quantities of coin, weight, or measure, to decimals, or to find the value of any decimal in the known parts of the integer.

Q. Under how many different cases, is reduction of decimals performed ?

A. Four different operations are performed in reduction of decimals, and these operations are arranged under four different cases.

CASE FIRST.

Q. What is the first case in reduction of decimals ?

A. It is to change a vulgar fraction to a decimal that shall retain the same value.

Q. What is the RULE in this case ?

A. Annex ciphers to the numerator, and divide by the denominator, and point off as many places for decimals, in the quotient, as you annex ciphers to the numerator ; if there are not so many figures, supply the defect by prefixing ciphers.

EXAMPLES.

1. Reduce $\frac{5}{8}$ to a decimal. 2. Reduce $\frac{3}{4}$ to a decimal.
Operation. $8 \overline{)5.000}$ Operation. $4 \overline{)3.00000}$

Ans. .625

Ans. .75

3. What decimal expression is equal to $\frac{7}{8}$? *Ans.* .875

4. What will be the decimal expressions of $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{5}$, and $\frac{1}{10}$? *Ans.* $\frac{1}{2}=.5$, $\frac{3}{4}=.75$, $\frac{1}{5}=.2$, and $\frac{1}{10}=.1$.

5. What decimal will be equal to $\frac{75}{100}$? *Ans.* .75

6. A manufacturing company sold to A. $\frac{4}{5}$ of their establishment, and soon after sold to B. $\frac{1}{5}$ of the remaining part, and D. purchased the residue ; what was B.'s and D.'s share of the whole, and what decimal will express each man's

Ans. B.'s share was $\frac{1}{5}$. D.'s, $\frac{1}{5}$. Decimal their shares, A.'s, .8. B.'s, .2. D.'s, .

REDUCTION OF DECIMALS.

7. If your divisor in division be 675, and your remainder be 250, what decimal will express its value? *Ans.* ,37037.
 8. Bring $\frac{6\frac{3}{4}}{1\frac{1}{2}}$, to a decimal expression. *Ans.* 34,666+
 9. Reduce $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{4}$, to an equivalent decimal. *Ans.* ,4421+
 10. What decimal is equal to $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{4}$ of $\frac{2}{3}$? *Ans.* ,2222+

CASE SECOND.

- Q. What is the second case in reduction of decimals?
 A. It is to change a decimal to its primitive vulgar fraction.
 Q. What is the RULE in this case?
 A. Write the proper denominator under the given decimal expression, (which makes it a vulgar fraction,) then reduce this fraction to its lowest term, and you will have the true, primitive fraction.

EXAMPLES.

1. Reduce ,24688, to its primitive vulgar fraction.
 Operation. $\frac{24688}{100000} = \frac{1543}{6250}$ *Ans.*
 2. Reduce ,125, to its primitive vulgar fraction. *Ans.* $\frac{1}{8}$.
 3. Reduce ,425, to its primitive vulgar fraction. *Ans.* $\frac{17}{40}$.
 4. What is the primitive vulgar fraction of ,625? *Ans.* $\frac{5}{8}$.
 5. Reduce ,37664, to its primitive vulgar fraction. *Ans.* $\frac{1177}{3125}$.
 6. Reduce ,825, to the least vulgar expression. *Ans.* $\frac{33}{40}$.
 7. Reduce ,00875, to its primitive vulgar fraction. *Ans.* $\frac{7}{800}$.

CASE THIRD.

- Q. What is the third case in reduction of decimals?
 A. To reduce quantities of different denominations, as of money, weight, measure, time, &c. to their equal decimal value.
 Q. What is the RULE in this case?
 A. Bring the given quantity to the lowest denomination mentioned in it, for a numerator; then reduce the integral part to the same denomination, for a denominator; lastly, bring this vulgar fraction to a decimal, by case first, and you will have the answer. Or by RULE second, write the numbers, perpendicularly, under each other for dividends, placing the lowest denomination at the top, and the others in their order, the highest denomination standing at the bottom; then begin with the top, or least denomination, and divide it by so many that name, as make one of the next higher, (annexing a

many ciphers as may be necessary,) and place the quotient, as decimal parts, at the right hand of the next dividend below; divide this dividend again, in the same manner, and thus proceed, till all the dividends have been divided, and the last quotient will be the decimal sought.

EXAMPLES.

1. Reduce 7 cwt. 3 qrs. 17 lbs. 10 oz. 12 dr. to the decimal of a ton.

Operation by rule 1st.	C.	qr.	lbs.	oz.	dr.	Operation by rule 2d.
	7	3	17	10	12	
	4					dr. 16)12,00
	31					
	28					oz. 16)10,75 1st quotient.
	265					lbs. 28)17,671875 2d do.
	62					qr. 4)3,631138 3d do.
	885					C. 20)7,907784 4th do
	16					
	5310					,395389 Ans.
	886					
	14170					
	16					
	85032					
	14170					
	226732					
	Numerator.					

Denom. 573440 Being the number of drams in a ton.

Then $226732 \div 573440 = ,395389 +$ Ans.

2. Reduce 3 qrs. 14 lbs. to the decimal of a cwt. Ans. ,875.

3. Reduce 7 oz. 13 pwt. to the decimal of a pound troy.

Ans. ,6375.

4. Reduce 72 days, to the decimal of a year. Ans. ,19726.

5. Reduce 2 qrs. 2 na. to the decimal of a yard. Ans. ,625

6. Reduce 2 roods, 16 rds. to the decimal of an acre.

7. Reduce 5 hours, to the decimal of a day.

8. Reduce 5 fur. 12 rods, to the decimal of a mile.

9. Reduce 26 galls. to the decimal of a pipe. Ans. ,625

10. Reduce 3 pts. to the decimal of a bushel.

CASE FOURTH.

Q. What is the fourth case in reduction of decimals?

A. It is to find the value of a decimal in the known parts of the integer.

Q. What is the RULE in this case?

A. Multiply the given decimal by the parts in the next lower denomination, (as in reduction descending,) and point off as many figures at the right hand of the product, as there are decimal places in the given decimal; multiply the remainder, or the figures so cut off, by the parts in the next less denomination, and cut off as before, and so proceed, till you have brought it to the lowest denomination required; then the several denominations, standing at the left hand of the cut off, will show the value sought.

EXAMPLES.

1. What is the value of ,395389 of a ton?

Operation. ,395389

Multiply by 20 cwt. the next lower denomination.

cwt. 7,907780

× 4 qrs. the next lower denomination.

qrs. 3,631120

× 28 lbs. the next lower denomination.

5048960

1262240

lbs. 17,671360

× 16 ounces, the next denomination.

4028160

671360

oz. 10,741760

× 16 drams, the next denomination.

4450560

741760

drs. 11,868160

Therefore the answer is 7 cwt. 3 qrs. 17 lbs. 10 oz. 11 dr.

What is the value of ,875 of a cwt.? Ans. 3 qrs. 14 lbs.

And the value of ,6375 of a lb. troy. Ans. 7 oz. 13 pwt.

4. How many days in ,19726 of a year? *Ans.* 72 ds. nearly.
5. Bring ,625 of a yard to qrs. and nails. *Ans.* 2 qrs. 2 na.
6. How much land in ,6 of an acre? *Ans.* 2 roods, 16 rods.
7. How many hours in ,2084 of a day? *Ans.* 5 hours.
8. What is the quantity of ,6625 of a mile? *Ans.* 5 fur. 12 rds.
9. Bring ,625 of an ell Fr. to qrs. and nails. *Ans.* 3 qrs. 3 na.
10. Bring ,20635 of a pipe of wine, to galls. *Ans.* 26 galls.
11. What is the quantity of ,046875 of a bushel? *Ans.* 3 pts.

MISCELLANEOUS QUESTIONS IN VULGAR AND DECIMAL FRACTIONS.

1. Add $\frac{1}{3}$, $\frac{2}{5}$, ,25, and ,125, together, and give the amount in a decimal expression. *Ans.* 1,108 $\frac{1}{4}$.
2. What is the amount of ,275, $\frac{5}{8}$, ,025, and $\frac{7}{12}$, added together in a vulgar fraction? *Ans.* 1 $\frac{61}{120}$.
3. What decimal will express the difference between $\frac{1}{15}$ and ,745? *Ans.* ,278 $\frac{1}{4}$.
4. If $\frac{5}{6}$, and $\frac{7}{12}$ be added together, and ,325, and ,4325 subtracted from their sum, what vulgar fraction will show the difference? *Ans.* $\frac{1373}{3600}$.
5. Add $\frac{1}{3}$ of $\frac{3}{4}$ of 12, to 14,0125, and from the sum, subtract $\frac{3}{5}$ of $\frac{3}{5}$ of 16; then multiply the difference by 4,25, and give the result in a vulgar fraction. *Ans.* 65 $\frac{5}{4}$.
6. Multiply 9 $\frac{5}{8}$, by $\frac{3}{4}$ of $\frac{5}{6}$ of 7 $\frac{1}{2}$, and divide the product by 9,75, and give the result in a decimal expression. *Ans.* 4,6274 $\frac{1}{4}$.
7. Add $\frac{1}{2}$ of a ton, ,75 of a cwt. $\frac{1}{2}$ of a quarter, and ,375 of a pound, and give the result in the known parts of the integer. *Ans.* 16 cwt. 3 qrs. 14 lbs. 6 oz.
8. Divide ,75 by itself, multiply the quotient by $\frac{2}{3}$, add ,625 to the product, then subtract 1 $\frac{1}{2}$, and see if any thing remain. *Ans.* Nothing.
9. A man bought ,24 of a factory, and sold $\frac{5}{15}$ of his share; what part of the factory did he sell, and what part of the whole does he still own? *Ans.* He sold $\frac{2}{3}$, or ,08, of the whole factory. He still owns $\frac{4}{25}$, or ,16 of the whole.
10. A man, left an estate to his four sons, worth \$16000, in such proportions, that as often as A. had \$3. B. had 4. C. 5. and D. 6; what proportion of the estate had each, and what was the amount of each one's share?

$$\text{Ans. } \begin{cases} \text{A. had } \frac{1}{6}. & \text{Amount of his share } \$2666,666\frac{1}{3}. \\ \text{B. had } \frac{2}{9}. & \text{Amount of his share } \$3555,555\frac{1}{3}. \\ \text{C. had } \frac{5}{12}. & \text{Amount of his share } \$4444,444\frac{1}{3}. \\ \text{D. had } \frac{1}{3}. & \text{Amount of his share } \$5333,333\frac{1}{3}. \end{cases}$$

11. Reduce $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$, to a common denominator, and give the sum, both in a vulgar and decimal expression.

Ans. Reduced to a common denominator, the fraction will appear in the following expressions, viz.: $\frac{9600}{19200}$, $\frac{6400}{19200}$, $\frac{4800}{19200}$, $\frac{3200}{19200}$, $\frac{2400}{19200}$, $\frac{1600}{19200}$, $\frac{1200}{19200}$; the amount in a vulgar form, $2\frac{7}{120}$; in a decimal, 2,6583 $\frac{1}{3}$.

12. What will 75 $\frac{1}{2}$ yards of silk cost, at .875 of a dollar per yard?
Ans. \$66,17 cts. .1875.

13. Four men built a ship, which cost \$28,000; A. owned such a part of her as cost him \$3500; what proportion of the ship did he own, and how much of his share must he dispose of, to sell $\frac{1}{6}$ of the whole ship? *Ans.* He at first owned $\frac{1}{8}$ part; and must sell $\frac{1}{4}$ of his share.

14. I bought $\frac{3}{8}$ of a lottery ticket, and drew \$4250; but having sold a certain part of my share, my portion of the money was only \$1328,125; how much of my share did I sell, and what part of the whole ticket did I still own? *Ans.* I sold $\frac{1}{4}$ of my share; and still owned $\frac{1}{8}$ of the whole.

FELLOWSHIP.

Q. What is to be understood by Fellowship?

A. Fellowship is a Rule by which the accounts of several merchants, or other persons, trading together, are so adjusted that each partner may have his share of the gain, or sustain his share of the loss, in proportion to his share of the joint stock. By this rule, also, the estates of bankrupts are divided among their creditors, and taxes assessed on all taxable property, according to its valuation.

Q. How many kinds of Fellowship are there?

A. Fellowship is of two kinds, single, and compound, or double.

SINGLE FELLOWSHIP.

Q. What is Single Fellowship?

A. It is when the several stocks are continued in trade for an equal term of time.

Q. By what RULE do you find each man's gain or loss, according to his stock in trade.

A. By the Rule of Three; say, as, the whole stock : is to the whole gain, or the whole loss : : so is each man's particular stock : to his share of the gain or loss.

EXAMPLES.

1. A. B. and C. joined their stock in trade; A. put in 300 dollars, B. 450 dollars, and C. 750 dollars; on settling their accounts, they found they had gained 500 dollars; what was each partner's share of the gain?

Operation. $\$300 + \$450 + \$750 = \$1500$ whole stock.

Then say, as $\$1500 : 500 :: 300 : \$100$ A.'s gain.

Then say, as $\$1500 : 500 :: 450 : \$150$ B.'s gain.

Then say, as $\$1500 : 500 :: 750 : \$250$ C.'s gain.

Or, add together A.'s and B.'s shares, and subtract the sum from the whole gain, and the remainder will be C.'s share.

2. A bankrupt finds he owes to A. \$250.18 cents; to B. \$114; to C. \$645.62 cents; and to D. \$354.70 cents; his whole property is sold for only \$1023.37½ cents; how much can he pay on a dollar, and how much must each creditor receive for his debt? *Ans.* He can pay 75 cents on a dollar; A. must receive \$187.635; B. must receive \$85.50; C. must receive \$484.215; D. must receive \$266.025.

3. Three merchants sent a ship to India, which, with the cargo, cost \$30000; A. owned $\frac{1}{3}$, B. owned $\frac{2}{3}$, and C. owned the rest; on her return, they found they had gained \$12500; what did each one pay out, for the vessel and cargo, and what was each one's share of the gain? *Ans.* A. paid \$6000, and gained \$2500; B. paid \$12000, and gained \$5000; C. paid \$12000, and gained \$5000.

4. Four house carpenters built a house in company; the lot on which it was built, cost \$1000; the lumber, and building materials, of all kinds, cost \$6,500; they paid for mason's work, 500 dollars; for painting and glazing, \$350. Of these expenses, A. paid $\frac{1}{4}$, B. $\frac{1}{4}$, C. $\frac{1}{4}$, and D. paid the residue. A. worked on the house 45 days, at \$1.50 a day, with three apprentices, who were allowed 75 cents a day, each; B. worked 75 days, at \$1.75 a day, with two journeymen, who were allowed \$1.25 a day, each; C. worked 60 days, at \$1.62½ a day, with one journeyman, at \$1.37½, and two apprentices at 87½ cents, each; D. worked 90 days, and being the master workman, was allowed \$2.25 a day, with two journeymen at \$1.75 a day, each, and two apprentices at \$1.25 a day, each; having completed the house, they sold it for 2500 dollars more than the cost, labor and all; how much money must each partner receive for his share, in proportion to what he contributed in money and labor, towards the building?

Ans. A.'s share \$3700.203; B.'s share \$3316.044; C.'s share \$2450.438; D.'s share \$3198.314. N. B. Whole \$9365; sold for \$12365.

5. A. B. and C. traded in company ; A. put in \$5760, B. put in \$2400, and C. put in \$1440 ; on settling their business, they found their gain to be \$960 ; what was each one's share of the gain ?

Ans. A.'s share, \$576. B.'s share, \$240. C.'s share, \$144.

6. Three merchants entered into partnership ; A. put in \$6000, B. \$4000, and C. \$2000 ; they gained $12\frac{1}{4}$ per cent on the whole stock in trade ; what was each one's share of the gain ?

Ans. A.'s gain was \$750. B.'s \$500. C.'s 250.

DOUBLE FELLOWSHIP.

Q. What is Double, or Compound Fellowship?

A. It is when the several shares of partners are continued in trade for an unequal term of time.

Q. What is the RULE for finding each partner's gain or loss ?

A. First multiply each partner's share, by the time it was continued in trade ; then add all these products together, and by the rule of three, say : as the sum of these products : is to the whole gain, or to the whole loss :: so is each partner's particular product : to his share of the gain or loss.

EXAMPLES.

1. Three merchants joined their stocks in trade ; A. put in \$600, for 6 months ; B. \$500, for 9 months : and C. \$300, for 12 months ; by their speculations they gained \$700 ; what was each man's share of the gain ?

mo.

Operation. A.'s share $\$600 \times 6 = 3600$ A.'s product.
 B.'s " $500 \times 9 = 4500$ B.'s product.
 C.'s " $300 \times 12 = 3600$ C.'s product.

11700 sum of all the products.

dolls. $\left\{ \begin{array}{l} 3600 : \text{to } \$215,384 \text{---} \text{A.'s gain.} \\ 4500 : \text{to } 269,23 \text{---} \text{B.'s gain.} \\ 3600 : \text{to } 215,384 \text{---} \text{C.'s gain.} \end{array} \right.$
 Therefore say, as 11700 : 700 ::

2. Three persons hired a large pasture, for \$250, in which to pasture their cattle ; on the first of May, each man turned in 40 head ; on the first of June, A. turned in 20 head more, but B. took out 15 head of his ; July 1st, B. turned in 20 head, and C. took out 20 head of his ; August 1st, A. took out 25 head, B. put in 25, and C. put in 30 head ; on the first of October, they give up the pasture, and settle the concern ; what must each man pay for the use of the pasture ?

Ans. A. must pay $\$84,558\frac{1}{4}$. B. $\$91,911\frac{1}{4}$. C. $\$73,529\frac{1}{4}$.

3. Four merchants entered into partnership; A. put in \$800, for 5 months; B. \$1200, for 7 months; C. \$1920, for 8 months; and D. \$2400, for 9 months; on closing their business, they find they have gained 1500 dollars; what must each partner receive for his share of the gain? *Ans.* A.'s share, \$121,55+. B.'s, \$255,26+. C.'s, \$466,77+. D.'s, \$656,40+.

4. On the first of January, A. began trade with \$760; on the first of May, following, B. joined in company with him, with a capital of \$540; on the first of August, following, they took in C. as a partner, with \$800; at the end of the year they divided a gain of \$872; what was each partner's share?

Ans. A.'s share, \$456. B.'s, \$216. C.'s, \$200.

5. A. and B. joined their stock in trade for 16 months; A. at first put in \$1200, and 9 months after, put in \$200 more; B. at first put in \$1500, but at the end of 6 months, took out \$500; at the expiration of the term, they found they had gained \$772,20 cents; what was each partner's share of the gain? *Ans.* A.'s share, \$401,70. B.'s, \$370,50.

6. A. and B. join in company, and put into stock \$600 each; but at the end of three months, A. takes out \$150, and B. puts in \$150 more; at the end of 6 months, A. puts in \$500, and 3 months after, B. puts in \$450; at the end of the year, they find they have gained \$1500; how much is each man's part of the gain? *Ans.* A.'s part 708. B.'s, \$792.

MISCELLANEOUS QUESTIONS.

1. A. B. and C. freighted a ship with 68900 feet of boards; A. put in 16520 feet; B. put in 28750 feet; C. put in the residue; in a storm, the captain threw 26450 feet, overboard; how must the loss be divided among them?

Ans. A. must lose 6341+ feet. B., 11036+. C., 9071+.

2. Three men built a house that cost them \$9500, and had insured for three-fourths of the amount; the house caught fire, and was destroyed; how much must each man receive of the insurance, allowing A. to have owned $\frac{1}{4}$, B. $\frac{2}{3}$, and C. the rest; and how much did each one lose?

Ans. { A. must receive \$1781,25 and lose \$593,75.
B. " " \$2850,00 " \$950,00.
C. " " \$2493,75 " \$231,25.

A. B. and C. put into joint stock, \$1200, in that, as often as A. paid \$3, B. paid 5, and C. \$600; what was each man's stock, and

Ans. { A.'s stock \$225, and his gain
B.'s stock \$375, and his gain
C.'s stock \$600, and his gain.

INVOLUTION.

4. A ship valued at \$90,000, was freighted with teas for A. valued at \$10,400; coffee for B. at \$3400; silks and crapes for C. at \$5000; and the freight was reckoned at \$6400; in a storm the captain was compelled to cut away the mast and rigging to preserve the ship, the repairs of which cost \$1536; what is the loss on every 100 dollars, and how much must each party pay, as his share of the loss?

Ans. { Average loss on \$100 is \$3. The ship must pay \$60.
Freight must pay \$192. A. must pay \$312.
B. must pay \$282. C. must pay \$150.

N. B. In averaging damages of vessels at sea, the value of the vessel, and the estimated value of the freight, pay their equal proportions.

5. A. B. and C. entered into partnership for 16 months; A. at first put into stock \$7400, but at the end of 4 months, took out \$3000, at the end of 12 months, he put in \$3000, but at the end of 14 months, took out \$850; B. at first put in \$5900, and at the end of 3 months, put in \$4300, but at the end of 9 months, took out \$4000, and at the end of 12 months, put in \$1500, but at the end of 14 months, took out \$3000; C. at first put in \$13000, but at the end of 6 months, took out \$5000, and at the end of 9 months, put in \$3200, but at the end of 12 months, took out \$4000; on settlement of their accounts, they had gained 8000 dollars; what was each partner's share of it?

Ans. { A.'s share \$2219,395 $\frac{1}{11}$
B.'s share \$2634,870 $\frac{1}{11}$
C.'s share \$3145,733 $\frac{1}{11}$

6. A. and B. traded in company; A. put in \$700 for 9 months; B. put in a certain sum for 12 months; they gained \$500, of which B. took \$150; what was B.'s stock? Ans. \$225.

INVOLUTION.

Q. What is to be understood by Involution?

A. Involution is the raising of powers, and teaches to find the power of any number, or to raise any given number to any proposed power.

Q. How are the powers of numbers designated?

A. They are designated by numbers, as 1st, 2d, 3d, 4th, &c.

Q. What is the first power of any number?

A. The number itself is called the first power, or root; as 5 the first power of 5; and 9 is the first power of 3.

is the second power of any number, and how is it

A. Any number, multiplied into itself, produces its second power, or square; as $5 \times 5 = 25$; the second power, or square of 5, marked 5^2 .

Q. What is the third power of any number, and how is it produced?

A. Any number, multiplied into its second power, or square, produces its third power, or cube, as $5 \times 5 \times 5 = 125$, the third power, or cube of 5, marked 5^3 .

Q. What is the fourth power, and how produced?

A. Any number, multiplied into its third power, or cube, produces its fourth power, or biquadrate, as $5 \times 5 \times 5 \times 5 = 625$, the fourth power of 5, marked 5^4 .

Q. What is the small figure that denotes the power, called?

A. It is called the Index.

Q. What is the general RULE for finding the required power of any given number?

A. Multiply the given number into itself, till the number of multiplications is one less than the index of the required power, and the last product will be the power required.

Q. How do you raise a vulgar fraction to a required power?

A. Raise the numerator to the required power, for a new numerator, and the denominator to the same power, for a new denominator.

Q. How do you raise a mixed number to any required power?

A. Reduce it to an improper fraction, and raise the numerator and denominator as before, or, reduce the fraction to a decimal, and multiply the whole into itself, as the rule directs, and point off the decimals, as in multiplication of decimals.

EXAMPLES.

1. What is the 4th power of 9?

$$\begin{array}{r}
 \text{Operation. } 9 \\
 9 \\
 \hline
 81 \text{ 2d power.} \\
 9 \\
 \hline
 729 \text{ 3d power,} \\
 9 \\
 \hline
 6561 \text{ 4th power, or answer.}
 \end{array}$$

2. What is the 4th power of $\frac{3}{5}$?

$$3 \times 3 \times 3 \times 3 = 81 \text{ 4th power of the numerator.}$$

$$5 \times 5 \times 5 \times 5 = 625 \text{ 4th power of the denominator}$$

Therefore, $\frac{81}{625}$ is the 4th.

3. What is the 2d power, or square of 21 ? *Ans.* 441.
 4. What is the 3d power, or cube of 4 ? *Ans.* 64.
 5. What is the 4th power of 1,05 ? *Ans.* 1,21550625.
 6. Raise $\frac{1}{2}$ to the 4th power. *Ans.* $\frac{1}{16}$.
 7. What is the square of $4\frac{3}{4}$? *Ans.* $18\frac{9}{16}$, or $19,56$.
 8. What fraction will express the 3d power of $\frac{1}{25}$?
Ans. $\frac{1}{15625}$.

EVOLUTION.

Q. What is Evolution ?

A. It is the extraction, or finding the root of any power.

Q. What do you understand by the extraction of the root of any power ?

A. It is to find the root, or the original number, from which the given power was raised or produced ; that is, to find such a number, as, being multiplied into itself, according to the index of the power, will produce the given power or number.

Q. Is there any number, from which a perfect power cannot be produced by Involution ?

A. There is not ; but there are many numbers of which an exact root can never be obtained.

Q. What are those numbers called, of which an exact root cannot be obtained ?

A. They are called surd numbers.

Q. What are those called, whose roots can be exactly found ?

A. They are called rational numbers.

Q. How can you approximate to, or find, with a sufficient degree of exactness, the root of a surd power ?

A. By the help or use of decimals, the root may be found to any necessary degree of exactness.

SQUARE ROOT.

Q. What is it to extract the square root of any number ?

A. It is to find such a number, as, being multiplied into itself, will produce that number.

Q. What is the RULE for extracting the square root of any number, or rather what is the first process in the operation ?

A. Point off the given numbers into periods of two figures each, by putting a point over the unit, and then over every third figure, from the right hand to the left.

Q. Why is it necessary to point off the figures into periods ?
 A. It is necessary, in order to know whether one or two

figures are to be taken, for the first operation ; it also shows how many figures the root will consist of.

Q. If there are decimals, how are they to be pointed ?

A. If the decimals consist of an odd number of figures, annex a cipher to make the places even, and then point them, as before directed.

Q. What is the next step, towards finding the root ?

A. Begin with the left hand period ; find the greatest figure, which, being multiplied into itself, will not exceed that period ; place this figure in the quotient, for the first figure of the root ; then place the square of it under the first period, and subtract it therefrom, and to the remainder bring down the next period, for a new dividend.

Q. You have now found the first figure of the root ; what is the next process ?

A. Double this first figure of the root, already found, and place the product at the left hand of the new dividend, for a divisor, see how many times this divisor is contained in the dividend, excepting the right hand figure, place the result in the quotient, and also at the right hand of the divisor ; then multiply this new divisor by the last quotient figure, place the product under the dividend, subtract it therefrom, and to this remainder, bring down the next period as before.

Q. You have now found the second figure of the root ; what is the next process ?

A. Double all the figures of the root, now found, for a new divisor, and proceed exactly as before, and thus continue, always remembering to double all the figures of the root, for each new divisor, until you have brought down and divided all the periods in the given power.

Q. If there are decimals in the given power, how many decimal places must be pointed off, in the quotient, or root ?

A. Point off as many places in the root, as there are periods in the given decimal power.

Q. If the given power be a surd, of which the exact root cannot be found, how do you proceed ?

A. Continue the process, by annexing periods of ciphers to the last remainder, as far as necessity requires.

Q. How do you extract the root of a vulgar fraction ?

A. Reduce the fraction to its lowest terms ; then extract the root of the numerator, for a new numerator, and of the denominator for a new denominator.

Q. If the fractions are surd numbers, how do you proceed ?

A. Multiply the numerator and denominator together, extract the square root of the product for a new numerator, which being written over the given denominator, as

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to its lowest terms, will form the root required ; or reduce the vulgar fraction to a decimal, and extract the root of that as before directed.

Q. How do you find the root of a mixed number ?

A. Reduce it to an improper fraction, or reduce the fraction to a decimal and extract the root, and in either case you will have the required root.

Q. In extracting the square root of surd numbers, how can you find the true denominator, to be placed under the remainder, after the work is finished ?

A. Double the quotient or root for a denominator, and write it under the remainder, and it forms the true fraction, which should always be annexed to the root, unless the process is continued in decimals.

EXAMPLES.

1. What is the square root of 30138696025 ?

Operation. 30138696025(173605 the root, or answer.

1

First divisor 27)201
189

Second divisor 343)1238
1029

Third divisor 3466)20969
20796

Fourth divisor 347205)1736025
1736025

2. What is the square root of 2025 ?

Ans. 45.

3. What is the square root of 17,3056 ?

Ans. 4,16.

4. What is the square root of ,000729 ?

Ans. ,027.

5. What is the square root of 3 ?

Ans. 1,73205.

6. What is the square root of 5 ?

Ans. 2,236068.

7. What is the square root of 1522756 ?

Ans. 1234.

8. What is the square root of 234,723 ?

Ans. 15,32.

9. What is the square root of 83521 ?

Ans. 289.

10. What is the square root of 5499025 ?

Ans. 2345.

What is the square root of ,00032754 ?

Ans. ,018094.

What is the square root of $\frac{1}{4}$?

Ans. $\frac{1}{2}$.

What is the square root of $\frac{9216}{15552}$?

Ans. $\frac{4}{3}$.

PRACTICAL QUESTIONS IN SQUARE ROOT.

1. What number, multiplied into itself, will produce 62500?

Ans. 250.

2. If an army of 103041 men were formed into a solid square, how many must be placed in rank and file?

Ans. 321.

3. A man bought a farm, containing 576 acres, lying in an exact square; now allowing the side of a square acre to measure 12,64 rods, how many rods of fence will enclose the farm; and how many rails, of 14 feet in length, will it require to fence it round, making the fence 5 rails high, allowing them to lap one foot at each end?

Ans. } It will require 1213,44 rods of fence.
And will require 8342,4 rails, to lay it.

4. If the area of a circle be 4096 square inches, what will be the side of a square that shall contain the same number of square inches?

Ans. 64 inches.

5. A gentleman has 1225 fruit trees, which he wishes to set in an orchard, forming an exact square; how many trees must he set on each side?

Ans. 35.

- Q. What is meant by the mean proportion between any two numbers?

A. When the first number : is to the second :: as the second : is to the third, the second is said to be a mean proportion between the other two numbers; thus 8 is a mean proportion between 4 and 16, for, as 4 : 8 :: 8 : 16.

- Q. By what RULE can you find the mean proportion between any two given numbers?

A. Multiply the two numbers together, and extract the square root of the product, and you will have the mean proportion.

6. What is the mean proportion between 18 and 72? *Ans.* 36.

7. What is the mean proportion between 60 and 240?

Ans. 120.

8. What is the mean proportion between 87 and 348?

Ans. 174.

- Q. Having the diameter of a pipe given, that will convey a given quantity of water in a given time, how can you find the diameter of another pipe, that will convey the same quantity in any required time?

A. Say, as the given time : is to the square of the given diameter :: so is the required time : to the square of the required diameter; extract the square root of the result, and you will have the answer.

- Q. Having the diameter of a pipe given, that will convey a certain quantity of water in a given time, how can you find the diameter of another pipe, that will convey the same quantity in any required time?

time, in which the same quantity of water would be conveyed by a pipe of a greater or less diameter ?

A. Say, as the square of the given diameter : is to the given time : : so is the square of the required diameter : to the required time, or answer.

☐ Observe whether the proportion be direct or inverse.

9. If a pipe $\frac{1}{4}$ of an inch in diameter, will fill a cistern in 4 hours, what must be the diameter of another pipe, that will fill the same cistern in 2 hours ? *Ans.* 1.06 inch.

10. If a pipe, the bore of which is one inch in diameter, will fill a cistern in 6 hours, in what time will a pipe two inches in diameter, fill the same cistern ? *Ans.* $1\frac{1}{2}$ hour.

11. If a pipe, $2\frac{1}{2}$ inches in bore, will run off a certain quantity of water in 8 hours, in what time will a pipe, 3 inches in bore, run off the same quantity ? *Ans.* 5 h. 33 m. 20 sec.

12. If a sluice way, 3 feet in diameter, will draw off a pond of water in 24 hours, in what time will the same pond be drawn off, if another sluice be opened at the same time, 6 feet in diameter, and both run together ? *Ans.* 4 h. 48 m.

Q. How can you form any number of men into the form of a square, so that the number in rank may be double, treble, or quadruple, &c. the number in file ?

A. Extract the square root of $\frac{1}{2}$, $\frac{1}{3}$, or $\frac{1}{4}$ of the given number of men, and that will be the number in file ; then multiply that number by 2, 3, or 4, as the question requires, for the number in rank.

Q. When the number in rank and file, and the distance they stand apart, are given, how can you find how much land they will cover ?

A. Subtract 1, from the number both of rank and file, and multiply each remainder by the distance they are to stand from each other ; then multiply these two products together, and the last product will be the answer.

13. If 10952 men are so placed, that the number in rank shall be double the number in file, what will be the number of each ? *Ans.* 148 in rank, and 74 in file.

14. If 2016 men are so placed, as to have 56 in rank, and 36 in file, and to stand 4 feet from each other, both in rank and file, how much ground would they cover ? *Ans.* 30800 feet.

15. A certain square pavement contains 20736 square stones, all of the same size ; I wish to know how many are contained one of its sides. *Ans.* 144.

If 12100 men be formed so that the number in rank shall be in file, how many will there be in rank and file ? *Ans.* 162 in rank. 81 in file.

17. I have 384 fruit trees, which I wish to set out, so as to have 24 in a row, one way, and 16 the other, and to stand 24 feet apart; how many acres will they cover?

Ans. 198720 feet, or 4 a. 2 r. 91 $\frac{1}{4}$ rods.

18. If a cistern, 8 feet in diameter, will contain 15000 gallons, what must be the diameter of a cistern of the same depth, to contain four times as much?

Ans. 16 feet.

19. A gentleman, owning a large tract of land, wishes to lay out a farm of 156 acres, so that the length may be double the width; how many rods in length and breadth must it measure?

Ans. 111,7 $\frac{1}{2}$ in breadth, and 223,4 $\frac{1}{2}$ in length.

20. If 10 hhds. of water are discharged through a leaden pipe of 2 $\frac{1}{2}$ inches in diameter, in a certain time, what must be the diameter of another pipe, to discharge four times as much water in the same time?

Ans. 5 inches.

CUBE ROOT.

Q. What is a cube, or a cubic body?

A. A cubic body is a body having six equal sides, each of which is an exact square.



Q. What is it to extract the cube root of any power?

A. It is to find such a number, as being multiplied into its square, will produce the given power. This root also shows the dimensions of a cubic block or figure, the solid contents of which, are equal to the given number or power.

Q. What is the first step towards extracting the cube root of any power?

A. Point off the figures into periods of three figures each, by placing a point over the unit, and then over every fourth figure from the place of units, towards the left hand.

Q. If there are decimals, how are they to be pointed?

A. Point every fourth figure from the unit, or whole number, towards the right hand; if the last period be not complete, annex ciphers to fill the deficiency.

Q. What is the next step to be taken?

A. Find the greatest figure, whose cube will not figures in the first left hand period; place the

found, in the quotient, for the first figure of the root, and place the cube under the first period, subtract it therefrom, and to the remainder, bring down the next period for a dividend.

Q. You have now found one figure of the root, what is your next process?

A. Multiply the square of the quotient by 300, calling it the triple square, and the quotient by 30, calling it the triple quotient, and the sum of these, call the divisor; next, see how many times this divisor is contained in the dividend, and place the result in the quotient; then multiply the triple square by this last quotient figure, and place the product under the dividend; multiply the square of the last quotient figure, by the triple quotient, and place this product under the last; under all, place the cube of the last quotient figure; next add these three products together, and call their sum the subtrahend; subtract the subtrahend from the dividend, and to this remainder bring down the next period, for a new dividend.

Q. Having thus found two figures of the root, how do you next proceed?

A. Repeat, precisely, the last process for the next figure of the root, and thus continue, till you have brought down and divided all the periods.

Q. If there be decimals in the given power, how many decimal places are to be pointed off in the quotient, or root?

A. Point off as many figures as there are periods in the given decimal power.

Q. If the given power be a surd, of which the exact root cannot be obtained, how can you arrive at a sufficient degree of exactness?

A. Continue the operation, by annexing periods of ciphers to the remainder, and proceed as before, until you have arrived at a sufficient degree of exactness.

Q. How do you extract the cube root of a vulgar fraction?

A. Reduce the fraction to its lowest term, then find the root of the numerator, for a new numerator, and also of the denominator, for a new denominator; or reduce the fraction to a decimal, and extract the root of that.

Q. In extracting the cube root of a surd power, how can you find a denominator to be placed under the remainder after the operation is finished?

A. Multiply the square of the quotient, or root, by 3, then multiply the root by 3, and add the two products together, and add the sum to the remainder, which should be the root, unless carried out by decimals.

EXTRACTION OF THE CUBE ROOT.

EXAMPLES.

1. What is the cube root of 436036824287?

triple square $7 \times 7 \times 300 + 7 \times 30 = 14700 + 210 = 14910$	triple quotient $210 \times 5 \times 5 = 5250$	Root. $436036824287(7583$
$7 \times 7 \times 7 = 343$		
$75 \times 75 \times 300 + 75 \times 30 = 1687500 + 2250 = 1689750$		
14161824		
Then, triple square, $1687500 \times 8 = 13500000$ Triple quotient, $2250 \times 8 \times 8 = 144000$ Cube of the last figure, $8 \times 8 \times 8 = 512$		
-13644512		
$758 \times 758 \times 300 + 758 \times 30 = 172369200 + 22740 = 172391940$		
517312287		
Then, triple square, $172369200 \times 3 = 517107600$ Triple quotient, $22740 \times 3 \times 3 = 204660$ Cube of the last figure, $3 \times 3 \times 3 = 27$		
-517312287		

- | | |
|---|-----------------------|
| 2. What is the cube root of 34965783? | Ans. 327. |
| 3. What is the cube root of 82881856? | Ans. 436. |
| 4. What is the cube root of 21024,576? | Ans. 27,6. |
| 5. What is the cube root of $\frac{8}{27}$? | Ans. $\frac{2}{3}$. |
| 6. What is the cube root of $\frac{1}{8}$? | Ans. $\frac{1}{2}$. |
| 7. What is the cube root of $2\frac{1}{8}$? | Ans. $1\frac{1}{2}$. |
| 8. What is the cube root of $\frac{32}{27}$? | Ans. $\frac{2}{3}$. |
| 9. What is the cube root of 195112; | Ans. 58. |
| 10. What is the cube root of 146363,183? | Ans. 52,7. |
| 11. What is the cube root of 48228,544? | Ans. 36,4. |
| 12. What is the cube root of $1\frac{1}{8}$? | Ans. $1\frac{1}{2}$. |
| 13. What is the cube root of $\frac{1}{8}$? | Ans. $\frac{1}{2}$. |

PRACTICAL QUESTIONS.

Q. What proportion do the contents of similar bodies bear to each other ?

A. Their proportions are as the cubes of their similar sides, or as the cubes of their diameters.

Q. Having the side of a cube, or its diameter given, how can you find the side, or the diameter of another cube, whose quantity shall be either more or less than the given cube ?

A. Cube your given side, or given diameter, and multiply or divide it by the ratio of the required cube, then, the cuberoot of the product will be the side or diameter required.

Q. What proportion do the strengths of different sized cables bear to each other ?

A. Their proportional strengths are to each other, as the cubes of their circumferences. Therefore say, as the strength of one cable : is to the cube of its circumference : : so is the strength of any other cable : to the cube of its circumference, the root of which will be the bigness round.

EXAMPLES.

1. If a cannon ball for a 32 pounder, be 8 inches in diameter, what will be the diameter of a ball for a 48 pounder ?

Ans. 9.15+ inches.

2. If a cable 12 inches in circumference, will bear an anchor weighing 18 cwt., what weight of anchor will a cable of 16 inches in circumference bear ?

Ans. 42½ cwt.

3. If a ball 3 inches in diameter weigh 6 pounds, what will a ball weigh, that is 6 inches in diameter ?

Ans. 48 lbs.

4. If an anchor, weighing 42½ cwt. require a 16 inch cable, what will an anchor of 18 cwt. require ?

Ans. 12 inch.

5. If a ball, weighing 48 pounds, be 6 inches in diameter, what will be the diameter of one that weighs but 6 pounds ?

Ans. 3 inches.

6. If a globe of silver, 3 inches in diameter, be worth \$150, what will be the value of a globe of the same purity, that is 6 inches in diameter ?

Ans. \$1200.

7. If a cube of silver, valued at \$1200, be 6 inches in diameter, what will be the diameter of a cube, of the same silver, worth \$150 ?

Ans. 3 inches.

measure contain 2150,425 cubic inches, what of a cubic box, to contain the same quantity ?

Ans. 12,907 inches.

9. If a globe of silver, 4 inches in diameter, be worth \$160, what will be the diameter of a globe, of the same metal, whose value is $\frac{1}{8}$ as much? *Ans.* 2 inches.

10. If a cubic box, measuring 12,907 inches, will hold a bushel, how many inches must a box measure to hold 8 bushels? *Ans.* 25,8 $\frac{1}{2}$ inches.

11. If a cask, 40 inches in length, and 32 inches at the bung diameter, will contain a certain quantity, what must be the dimensions of a cask, that will contain twice as much?

$40 \times 40 \times 40 \times 2 = 128000$; then $\sqrt[3]{128000} = 50,3\frac{1}{2}$ in. length.
 $32 \times 32 \times 32 \times 2 = 65536$; then $\sqrt[3]{65536} = 40,3\frac{1}{2}$ bung diam.

Ans. Therefore, is 50,3 in. in length. 40,3 in. in diameter.

12. There is a cistern that measures 8 feet in depth, and 4 feet in diameter; the pipe, that conveys the water into it, is 2 inches in diameter, and will fill it in 45 minutes; what must be the dimensions of a cistern, of a like shape, that shall contain just three times the quantity; and what must be the diameter of a pipe that will fill it in 60 minutes? *Ans.* Depth of cistern, 11 feet, 6 $\frac{1}{2}$ in. Diameter of the cistern, 5 feet, 8 $\frac{1}{2}$ in. Diameter of the pipe, 3 inches.

DUODECIMALS, OR CROSS MULTIPLICATION.

Q. What do you understand by Duodecimals, or Cross Multiplication?

A. It is a rule by which workmen and artificers, such as painters, carpenters, masons, &c. measure their work; it is also used for measuring wood, boards, timber, &c.

Q. What are the denominations generally used in this measurement?

A. They are feet, inches, or primes ('), seconds (''), thirds (''''), fourths (''''), fifths (''''), &c.

Q. In what proportion do these denominations increase, from the lower to the higher?

A. In a 12 fold proportion; that is, 12 fourths ('''') make 1 third (''''), 12 thirds ('''') make 1 second (''), 12 seconds ('') make 1 prime, or inch ('), and 12 inches (') make 1 foot.

Q. Why is this division of feet called duodecimals?

A. It is so called from the Latin word "duodecim," which signifies 12, because the integer is divided into 12 parts, and these parts, subdivided into 12 parts, and so on.

Q. What are those marks that denote primes, seconds, fourths, &c. called?

A. They are called indexes, or indices.

Q. If feet be multiplied into inches, or any of the smaller denominations, what will the product be ?

A. The product will always be of the same denomination with the least term multiplied ; that is, feet multiplied into inches, produce inches ; feet multiplied into seconds, produce seconds ; feet multiplied into thirds, produce thirds, &c.

Q. If any of the smaller denominations be multiplied together, what will the product be ?

A. The product will be a denomination as much less than the lowest term multiplied, as the highest term multiplied, is less than an integer, or foot.

Q. Can you explain this more particularly ?

A. Inches, or primes ($'$), multiplied into primes ($'$), produce seconds ($''$) ; because primes are one degree below an integer, or foot, therefore the product will be one degree below the terms multiplied, that is, seconds ($''$). Seconds ($''$), multiplied into seconds ($''$), produce fourths ($''''$) ; because seconds are two degrees below an integer, or foot, therefore the product will be two degrees below the terms multiplied, that is, fourths ($''''$). Thirds ($'''$), multiplied into fourths ($''''$), produce sevenths ($'''''$) ; because thirds (the highest term multiplied) are three degrees below a foot, therefore the product will be three degrees below fourths (the lowest term multiplied) which will make sevenths ($'''''$), and so on with any denomination whatever.

Q. Is there any plain, invariable rule, by which the proper index for the product of any two terms, multiplied together, can be found without the possibility of mistake ?

A. Yes. The index of any product can always be found, by adding together the indices of the two terms, multiplied ; thus, $4'' \times 5''' = 20''''$; because $('') + (''') = ('''')$, and so with any other indices.

Q. How are duodecimals added and subtracted ?

A. In the same manner as all other compound numbers ; carrying for every 12, from one denomination to another.

Q. What is the rule for multiplying duodecimals ?

A. Place the multiplier under the multiplicand, so that the same denominations may stand directly under each other ; begin with the highest denomination in the multiplier, and multiply it into the lowest denomination of the multiplicand, divide the product by 12, and (if the multiplier be feet) set the remainder under the term multiplied ; but if the multiplier be any term less than an integer, or foot, place the remainder so as to the right of the multiplicand, as its proper index, carrying the quotient to the next higher denomination compound multiplication. In the same manner, multiply each term in the multiplier, separately, proceeding

from the highest term to the lowest, remembering to place the remainder of each product, one place or degree to the right hand of the former, as its proper index will direct, and so continue, till you have multiplied all the terms of the multiplicand by each term of the multiplier, separately, then add the several products together, as in compound addition, and their sum will be the answer.

EXAMPLES.

$$\begin{array}{r} \text{ft.} \quad ' \quad '' \\ \text{1. Multiply } 9 \quad 8 \quad 6 \\ \text{By } 7 \quad 9 \quad 3 \end{array}$$

$$\begin{array}{r} 67 \quad 11 \quad 6 \\ 7 \quad 3 \quad 4 \\ 2 \quad 5 \quad 1 \end{array} \begin{array}{l} \text{product by the feet in the multiplicand.} \\ \text{product by the inches, or primes.} \\ \text{product by the seconds.} \end{array}$$

Feet 75 5 3 7 6''' Ans.

2. What is the product of 8 feet, 4', 8'', multiplied by 9', 4'', 8'''? *Ans.* 6 feet, 6', 9'', 6''', 5''''', 8'''''.

3. What is the product of 12 feet, 6', multiplied by 9', 4'', 3'''? *Ans.* 9 feet, 8', 11'', 1''', 6''''.

4. What is the product of 24 feet, 9', 8½'', multiplied by 1 foot, 6½'? *Ans.* 37 feet, 8', 9'', 2''', 1''''', 6'''''.

5. Multiply 19 feet, 11', into itself, and what is the product? *Ans.* 396 feet, 8', 1''.

6. How many solid feet, in a block 3 ft. 8 in. wide, 3 ft. 5 in. thick, and 6 ft. 7 in. long? *Ans.* 82 ft. 5', 8'', 4'''.

7. How many square feet, in a board 17 feet, 7 inches long, and 1 foot, 5 inches wide? *Ans.* 24 ft. 10', 11''.

8. How many solid feet, in a cubic block 6 feet, 9' square? *Ans.* 307 ft. 6', 6'', 9'''.

9. How many cubic feet, in a stick of timber 12 feet, 10 inches long; 1 foot, 7 inches wide; and 1 foot, 9 inches thick? *Ans.* 35 ft. 6', 8'', 6'''.

10. What must I give for 6 boards, each measuring 14 ft. in length, and 1 ft. 6 in. in breadth, at 2½ cts. a ft.? *Ans.* \$2,83½.

11. What will a stick of timber be worth, measuring 36 feet, 9 inches long, 9 inches wide, and 7½ inches thick, at 16 cents the cubic foot? *Ans.* \$2,75+cts.

12. Bought a stock of boards, 9 in number, 9 ft. 6 in. long, and 1 ft. 7 in. wide; what did they cost? *Ans.* They measured 135 ft. 4½ in.

DUODECIMALS APPLIED TO MEASURING WOOD.

Q. How is wood estimated, in buying and selling ?

A. By the cord, or by the cord-foot.

Q. What do you understand by a cord-foot of wood ?

A. Sixteen solid or cubic feet ; that is, 4 feet long, 4 feet wide, and one foot high, make a cord-foot.

Q. How many such cord-feet make one cord of wood ?

A. Eight ; that is, 8 feet long, 4 feet wide, and 4 feet high, make one cord.

Q. How do you measure a load of wood, in a cart or wagon ?

A. If the wood be of customary length, (8 feet,) multiply the average width by the height, and half the product will be the number of cord-feet.

Q. If the load be not 8 feet long, how do you measure it ?

A. Multiply the length by the average width, and that product by the height, then divide this last product by 16, and the quotient will be the number of cord-feet.

Q. How do you find the number of cords of wood, contained in any number of cord-feet ?

A. Divide the number of cord-feet by 8, and the quotient will be the number of cords.

EXAMPLES.

1. How many feet of wood, in a load 3 feet, 9 inches wide, 4 feet, 3 inches high, and of full length ?

$$\begin{array}{r}
 \text{Ft.} \\
 \text{Operation.} \quad 4 \quad 3 \\
 \quad \quad \quad 3 \quad 9 \\
 \hline
 \quad \quad 12 \quad 9 \\
 \quad \quad 3 \quad 2 \quad 3'' \\
 \hline
 2)15 \quad 11 \quad 3''
 \end{array}$$

Feet 7 11 $7\frac{1}{2}$ Ans.

2. How many feet, in a load of wood, $7\frac{1}{2}$ feet long, 4 feet, 3 inches wide, and 5 feet, 9 inches high ; and what must you pay for it, at \$5.50 cents a cord ?

Operation. $7\frac{1}{2}$ ft. $\times$ 4 ft. $3' \times 5$ ft. $9' \div 16 = 11$ ft. 5 in. $\frac{1}{2}$

Ans. 11 ft. 5 inches, and will cost \$7.848 m.

3. How much wood in a load, and what must you give for it, measuring 3 ft. 4 in. in width, 2 ft. 6 in. high, and full length, paying at the rate of \$6 the cord ?

Ans. 4 ft. 2 in. Must give \$3.12 $\frac{1}{2}$.

4 How much wood in a load, 12 ft. long, 3 ft. 8 in. wide, and 4 ft. 10 in. high ; and how much must I pay for it, at \$6,50 cents a cord ? *Ans.* 13 ft. 3½ in. Must pay \$10,799 m.

5. A poor woman bought a load of wood, measuring 3½ ft. in length, 2 ft. 8 in. in width, and 2½ feet in height ; how much wood was there, and what must she pay for it, at the rate of \$4,37½ a cord ? *Ans.* 1 ft. 4½ in. Amount, 74 cents, 4 m. +

6. How much wood can be put into a wagon, whose body is 8 ft. 9 in. long, 4 ft. 3 in. wide, and the stakes 5 ft. 8 in. high ; and what will it be worth, at \$6½ a cord ?

Ans. 1 cord, 5 ft. 2 in. Is worth \$10,49 cts. +

7. Bought a load of wood, measuring 7 ft. 8 in. in length, 3 ft. 9 in. in width, and 5 ft. 7 in. in height ; how many feet of wood in the load, and what must I pay for it, at the rate of \$7 a cord. *Ans.* 1 cord, 2 feet +. Must pay for it \$8,75 +.

8. If I buy a load of wood, measuring 7 ft. 8 in. in length, 4 ft. 6 in. wide, and 3 ft. 10 in. high, how many feet does it contain, and what must I pay for it, at the rate of \$6,75 cents the cord ? *Ans.* 8½ feet. Must pay \$6,96.

9. Two persons bought a load of wood together ; A's end of the load measured 3 ft. 9 in. wide, 4 ft. 6 in. high, and 4 ft. 3 in. long ; B's end measured 3 ft. 7 in. wide, 4 ft. 11 in. high, and 4 ft. 3 in. long ; how much wood had each, and what must each pay, at the rate of \$5,50 a cord ?

Ans. { A. had 4 feet, 5½ inches +. Must pay \$3,07 +.
 { B. had 4 feet, 8 inches +. Must pay \$3,20 +.

ARITHMETICAL PROGRESSION.

Q. What is an Arithmetical Progression ?

A. It is any rank of numbers, more than two, increasing by a common excess, or decreasing by a common difference.

Q. What is such a rank of numbers, as 2 : 4 : 6 : 8 : 10 : 12, &c. called ?

A. It is called an ascending arithmetical series.

Q. What is such a rank of numbers, as 12 : 10 : 8 : 6 : 4 : 2 &c. called ?

A. It is called a descending arithmetical series.

Q. What is to be understood, when you speak of the terms of an arithmetical progression ?

A. It is the numbers, or rank of numbers, that form the series.

Q. How many parts are always included in an arithmetical series ?

A. Five parts, viz.: 1. The first term. 2. The last term. 3. The number of terms. 4. The common difference. 5. The sum of all the terms.

Q. What is meant by the extremes of a progression ?

A. The first term and the last term are called the two extremes. The other terms are called the means.

Q. How many parts of an arithmetical series, must always be given, to find any other part required ?

A. Three. By having any three parts given, the other two may be easily found.

CASE FIRST.

Q. What is the first case in arithmetical progression ?

A. It is when one of the extremes, the common difference, and the number of terms of an arithmetical series, are given, to find the other extreme.

Q. What is the RULE in this case ?

A. Subtract one from the number of terms, and multiply this remainder by the common difference; then (if the greatest or last term be required; add the first, or least term to the product, and the sum will be the last term, or answer; but, if the first or least term be required, subtract the product from the greatest or last term, and the remainder will be the first term.

EXAMPLES.

1. If the least term of an arithmetical series be 3, the common difference 2, and the number of terms 9, what will be the greatest or last term ?

Operation. $9-1=8$ number of terms less by 1.
 $\times 2=$ common difference.

—
 16
 $+3=$ the first or least term.

—
 Ans. 19= the greatest or last term.

2. If the greatest term of a series be 70, the common difference 3, and the number of terms 21, what is the least term ?

Operation. $21-1=20=$ number of terms, less by 1.
 $\times 3=$ common difference.

—
 60

$70-60=10$ the first term, or answer.

A pay one dollar the first week, 3 dollars the second, and continue to increase his payment 3 dollars, every term of one year; what will be the amount of his 52d payment ?

Ans. \$163

4. A debt was discharged in a year, by paying a certain sum the first week, and increasing each weekly payment by \$2, the last payment being \$103; what was the first? *Ans.* \$1.

5. A. owes to B. a certain sum of money, which he agrees to pay in arithmetical progression; the first payment to be \$3, the number of payments 24, and the common difference 2; what will be the amount of the last payment? *Ans.* \$49.

6. If a man travel 15 days, and increase each day's journey 4 miles, and the last day travel 75 miles, how far must he have travelled the first day? *Ans.* 19 miles.

CASE SECOND.

Q. What is the second case in arithmetical progression?

A. It is when the two extremes and common difference are given, to find the number of terms?

Q. What is the RULE in this case?

A. Divide the difference of the extremes, by the common difference, add 1 to the quotient, and the sum will be the number of terms.

EXAMPLES.

1. If the two extremes are 3 and 27, and the common difference 2, what is the number of terms?

Operation. $27 - 3 \div 2 + 1 = 13$ the number of terms.

2. A man travelled 15 miles the first day, and increased his journey 3 miles a day, until he travelled 75 miles in a day; how many days did he travel? *Ans.* 21 days.

4. A man discharged a debt by weekly payments, and paying one dollar the first week, increasing his payment 5 dollars each week, until his last payment was 81 dollars; how many payments did he make? *Ans.* 17.

CASE THIRD.

Q. What is the third case in arithmetical progression?

A. It is when the extremes and number of terms are given, to find the common difference.

Q. What is the RULE in this case?

A. Divide the difference of the extremes, by the number of terms, less 1, and the quotient will be the common difference.

EXAMPLES.

1. In an arithmetical series, the extremes are 3, and the number of terms, 13; what is the common difference?

Operation. $27 - 3 \div 13 - 1 = 2$, the common difference.

2. The two extremes of a series are 7, and 67, and the number of terms 16; what is the common difference? *Ans.* 4.

3. A person on a journey, travelled 21 days, going 15 miles the first day, and 75 miles the last; what was his daily increase? *Ans.* 3 miles.

4. A debt was paid in 17 weeks, by paying one dollar the first week, and 81 dollars the last; what was the weekly increase of the payments? *Ans.* 5 dollars.

CASE FOURTH.

Q. What is the fourth case in arithmetical progression?

A. It is when the two extremes, and the number of terms are given, to find the sum of the series.

Q. What is the Rule in this case?

A. Add the two extremes together, and multiply their sum by the number of terms, and half the product will be the answer, or sum of the series.

EXAMPLES.

1. The first term of an arithmetical series is 3, the last term 63, and the number of terms 21; what is the sum of the series?

Operation. $63+3=66$. Then $66 \times 21 \div 2 = 693$ *Ans.*

2. A man travelled 15 days, in arithmetical progression, going 15 miles the first day, and 85 miles the last day; how many miles did he travel in all? *Ans.* 750 miles.

3. A merchant sold 26 yards of broadcloth, the first yard for $12\frac{1}{2}$ cents, the last for \$7,87 $\frac{1}{2}$, arithmetical; what was the common difference, and what did the whole amount to?

Ans. Common difference, 31 cts. Whole amount, \$104.

4. A man sold a farm of 100 acres, at \$5 for the first acre, increasing the price of each succeeding acre, by \$3; what did the last acre sell for, and to what did the whole amount?

Ans. The last acre sold for \$302. Whole amount \$15350.

5. A merchant sold 25 yards of cloth, in arithmetical progression, the first yard for 10 cents, the last yard for \$2,50; what was the rate of increase, and to what did the whole amount? *Ans.* Common difference, 10 cts. Amount, \$32,50.

6. A person bought 50 acres of land, at \$75 an acre; a gentleman offered to purchase it, by paying \$10 for the first acre, and increasing the price of each acre, by \$5 arithmetical; what was the average price per acre, and would the man make, or

Ans. { Average price per acre, \$132,5'
He would make \$2875.

GEOMETRICAL PROGRESSION.

Q. What is a Geometrical Progression.

A. It is a series of numbers which is increased by a common multiplier, or decreased by a common divisor.

Q. What is such a series as 1 : 3 : 9 : 27 : 81 &c. called ?

A. It is called an ascending series, and is increased by the common multiplier, 3.

Q. What is such a series as 64 : 32 : 16 : 8 : 4 : 2 &c. called?

A. It is called a descending series, and is decreased by the common divisor, 2.

Q. How many, and what are the parts to be noticed in geometrical progression ?

A. There are five parts, viz.: 1. The first term. 2. The last term. 3. The number of terms. 4. The ratio; that is, the common multiplier or divisor. 5. The sum of all the terms, or series.

Q. How many of these terms must always be given to find the others ?

A. Three; by having any three of the above terms given, the other two may be easily found.

CASE FIRST.

Q. What is the first case in geometrical progression ?

A. It is when the number of terms, the common ratio, and either of the extremes, are given, to find the other extreme.

Q. What is the RULE in this case ?

A. Raise the common ratio to a power whose index shall be one less than the number of terms; then multiply this power by the less extreme, or first term, and the product will be the greater extreme, or last term; or divide the greater extreme, or last term, by the power of the ratio, and the quotient will be the less extreme, or first term.

EXAMPLES.

1. If the first term of a geometrical series be 4, the common ratio 2, and number of terms 10, what will be the last term ?
Operation.

$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 512$ the 9th power of the ratio.
Then, 512×4 (the first term) = 2048, the last term, or answer.

[F In raising the ratio, or any number to a very high power, the most convenient method is to write down, in a line, the 2d, 3d, 4th, 5th, &c. power of the number, with the index over each; add such of the indices of those

2. If a body were to move 18 miles the first day, 72 m. the second day, and increase its velocity every succeeding day, in quadruple proportion, how long would it be in passing round the globe, allowing the distance to be 24570 miles? *Ans.* 6 days.

3. Suppose one of the fixed stars to be placed at the immense distance of 205,891,132,094,646 miles from this earth, and a body of matter should be projected from it, towards the earth, and should fall but 6 miles during the first day, 18 miles during the second day, and continue to increase its velocity each succeeding day, in triple proportion, how many days would it require to reach the earth? *Ans.* 29 days.

CASE FOURTH.

Q. What is the fourth case in geometrical progression?

A. It is when the first term, the common ratio, and the number of terms are given, to find the sum of all the terms.

Q. What is the Rule in this case?

A. Raise the ratio to a power whose index shall be equal to the number of terms, from which subtract 1; divide the remainder by the ratio, less 1; then multiply this quotient by the first term, and the product will be the sum of all the terms.

EXAMPLES.

1. If the first term be 5, the ratio 3, and the number of terms 7, what will be the sum of the series?

1 2 3 4

Operation. Ratio, 3 : 9 : 27 : 81

3 + 4 = 7

Then $27 \times 81 = 2187$ — the 7th power of the ratio, 1

Subtract the first term, 1

Divide by 3, less 1 = 2) 2186

1093

Multiply by 5 the first term.

5465 *Ans.* or sum of the series.

2. If I sell a piece of broadcloth, containing 13 yards, at 2 cents for the first yard, 4 cents for the second, and continue to double the price of each succeeding yard, what will the whole amount be, and what will be the average price per yard?

Ans. { Whole amount, \$163.82.

{ Average price per yard, \$12.52.

3. If a man should travel 3 miles the first day, and double his distance every day for 7 days, how far would he travel in all, and how far on the last day? *Ans.* { Whole distance, 381 m.
Last day's journey, 192.

4. A gentleman, upon the marriage of his only daughter, was unable to give her any portion; but on the wedding day gave her only 10 cents, ignorantly promising to double the sum, every week for one year; had he been able to perform his promise, what would have been his daughter's portion?

Ans. \$450,359,962,737,049,50 cents.

5. If a body were put in motion, to travel 18 miles the first day, 72 miles the second, and continue to increase its velocity, each day, in a quadruple proportion, for 6 days, how far would it travel in all, and how far would it go the last day?

Ans. Whole distance, 24570 m. Last day's travel, 18432 m.

6. If, by some internal explosion, a body should be propelled from one of the distant fixed stars, towards the earth, and should traverse but 6 miles the first day, 18 miles the second, and continue to increase its velocity in triple proportion, geometrical, till it reached the earth in 29 days, I wish to know how many miles that star must be from the earth?

Ans. 205,891,132,094,646 miles.

7. An honest old farmer wished to hire a man for a year, but utterly refused to give him 15 dollars a month, thinking the price too high; the young man, having some knowledge of the power of numbers, offered to work a year for the very small sum of 10 wheat corns for the first month, 100 corns for the second, and increase each monthly payment, in tenfold proportion, geometrical; and to make the bargain still easier for the farmer, he would sell him the wheat at the rate of 100,000 kernels for a cent; what was the amount of his year's wages?

Ans. \$111,111,11 cents, 1 m. +

8. A laceman agreed with a gentleman to sell him 22 yards of rich, gold, brocade lace, very costly, at the small price of 2 pins for the first yard, 6 pins for the second, and so on, in triple proportion; I wish to know how much the lace amounted to, if the pins were valued at 100 for a farthing?

Ans. £326886 0s. 9d.

CASE FIFTH.

Q. What is the fifth case in geometrical progress?

A. It is when the first term, the ratio, and the series are given, to find the last term.

Q. What is the RULE in this case?

T

A. Multiply the sum of the series by the ratio, less 1, to this product add the first term; then divide the sum by the ratio, and the quotient will be the last term.

EXAMPLES.

1. If the first term of a geometrical series be 5, the ratio 3, and the sum of the series 5465, what is the last term?

Operation. $5465 \times 3 - 1 = 10930$ and $10930 \div 5 = 10935$.

Then $10935 \div 3 = 3645$, the last term, or Ans.

2. A butcher bought 13 sheep in a geometrical ratio, which cost him \$163.82, by making the foolish agreement to give 2 cts. for the first, 4 cts. for the second, &c. doubling the price of each sheep; what did the last sheep cost? Ans. \$81.92.

3. If a body were to pass from a fixed star, at the distance of 205,891,132,094,646 miles from the earth, in 29 days, by travelling 6 miles the first day, 18 miles the second, and so on in a threefold ratio, what distance would it traverse during the last day? Ans. 137,260,754,729,766 miles.

4. A man had 10 acres of very valuable land, which being appraised at \$100 an acre, the purchaser thought the price too high, but readily consented to give 10 cents for the first acre, and increase the price of each acre in 10 fold proportion, geometrical; what did the 10 acres amount to, and what was the price of the last acre?

Ans. { Whole amount \$111,111,111, 10 cents.
 { Last acre \$100,000,000.

ALLIGATION.

Q. What is Alligation?

A. It is a rule which teaches to mix several simples of different qualities, or prices, so that the composition or mixture may be of a mean or middle quality, bearing a mean or average price of the different ingredients, composing the compound; and is of two kinds, viz.: Alligation Medial, and Alligation Alternate.

ALLIGATION MEDIAL.

Q. What is Alligation Medial?

A. The several quantities and prices of the articles are given, to find the average or mean price of the whole compound.

Q. What is the RULE for alligation medial ?

A. Find the value of each quantity to be mixed, at its given price, and add the several quantities into one sum, and their several amounts into another; then, by the rule of three, say, as the whole quantity to be mixed : is to the whole value of the mixture : : so is any part, or quantity of the mixture : to its proper value.

EXAMPLES.

1. A grocer mixed 25 gallons of wine, at 80 cents a gallon, with 30 gallons at 70 cts. 45 gallons at 90 cts. and 50 gallons at 45 cents a gallon; what was the mixture worth per gallon?

Operation.	25 gallons,	$\times 80 =$	\$20
	30 "	$\times 70 =$	21
	45 "	$\times 90 =$	40,50
	50 "	$\times 45 =$	22,50

[mixture.

Whole quantity, 150 galls. worth \$104,00 whole value of the Then, as 150 gallons, : \$104 : : 1 gallon, : 69 $\frac{1}{2}$ cents, *Ans.*

2. A grocer had 5 cwt. of sugar, at \$8 the cwt., 4 cwt. at \$6, 3 cwt. at \$10, and 3 cwt. at \$12, which he wished to mix, in order to find a more ready sale; what will 4 cwt. of the mixture be worth? *Ans.* \$34,66 $\frac{2}{3}$.

3. A farmer mixed an equal quantity of corn, at 75 cents, oats, at 37 $\frac{1}{2}$ cents, and buckwheat, at 62 $\frac{1}{2}$ cents, together; what is the mixture worth per bushel? *Ans.* 58 $\frac{1}{2}$ cents.

4. A vintner mixed 120 gallons of wine, worth \$1,25 a gallon, with 130 gallons at 90 cents, 150 gallons at 80 cents, and 275 gallons at 37 $\frac{1}{2}$ cents, into which he put 75 gallons of water; what must he sell it for per gallon, to make \$150 on the whole quantity? *Ans.* 85 cents, 3 $\frac{1}{2}$ mills.

5. A refiner mixed 6 ounces of gold, of 22 carats fine, 8 ounces of 18 carats, 9 ounces of 16 carats, with 12 ounces of alloy; of how many carats fine was the whole compound? *Ans.* 12 carats.

6. A butcher bought 15 sheep, at \$1,25 a head, 12 at \$1,12 $\frac{1}{2}$, 25 at \$1,37 $\frac{1}{2}$, 30 at 90 cents, and 18 at \$1,20; on driving them to market, he sold them all at the same price, by which he made \$62 $\frac{1}{2}$; at how much did he sell them per head? *Ans.* \$1,77 cents, 7 $\frac{1}{2}$ mills.

7. A merchant bought four different kinds of tea, at 37 $\frac{1}{2}$ cts. 62 $\frac{1}{2}$ cts. 87 $\frac{1}{2}$ cts. and \$1,12 $\frac{1}{2}$ per lb.; he was afterwards 85 cents a lb. for the whole together; I wish to know he would make or lose by selling it at that rate, and per pound? *Ans.* He would gain 10 cent

ALLIGATION ALTERNATE.

Q. What is Alligation Alternate?

A. It is a rule which teaches, by having the prices of several articles given, to find how much of each must be taken, to make a mixture which shall bear a certain given price.

NOTE.—This rule is exactly the reverse of alligation medial, and each may be proved by the other.

CASE FIRST.

Q. What is the first case in alligation alternate?

A. It is when the particular prices of several ingredients are given, to find what quantity of each ingredient will make a mixture, that shall bear a given price.

Q. What is the RULE in this case?

A. First, bring the prices of the several ingredients to the same denomination, and place them in a column under each other, the least being at the top, and increasing downwards in regular order; then place the mean or given rate of the mixture (in the same denomination,) at the left hand of this column.

Secondly, connect by a continued line, the price of each ingredient which is less than the mean rate, with one, or any number of those, which are greater than the price of the compound; and each greater price, with one, or any number of those, which are less than the mean rate, or mixture price.

Thirdly, find the difference between the mean price, or mixture rate, and that of each ingredient, and place this difference opposite to that, with which it is tied or linked; then if one difference only stand against any rate, that difference, or number, will show the proper quantity belonging to that particular rate; but if two, or more differences, stand against any rate, their sum will show the proper quantity.

EXAMPLES.

1. A wine merchant would mix wines of different prices viz.: at 80 cents, 75 cents, \$1.45, and \$1.50, in such quantities that the mixture may be worth \$1.35 a gallon; how much of each kind must he use in the mixture?

Operation 1.

35	{	75	—15 galls. at \$0.75 cents.	} Ans
		80	—10 galls. at \$0.80 cents.	
		145	—55 galls. at \$1.45 cents.	
		150	—60 galls. at \$1.50 cents.	

Operation 2.

135	75	—10	galls. at \$0,75 cents.	} Ans.
	80	—15	galls. at \$0,80 cents.	
	145	—60	galls. at \$1,45 cents.	
	150	—55	galls. at \$1,50 cents.	

2. A goldsmith would mix gold of 19 carats fine, with some of 16, 18, 23, and 24 carats fine, so that the compound may be 21 carats fine; what quantity of each must he take?

21	16	—3	ounces of 16 carats.	} Ans.
	18	—3	ounces of 18 carats.	
	19	—2	ounces of 19 carats.	
	23	—2	ounces of 23 carats.	
	24	—5 + 3 = 8	ounces of 24 carats.	

21	16	—3	ounces of 16 carats.	} Ans.
	18	—2	ounces of 18 carats.	
	19	—2	ounces of 19 carats.	
	23	—3 + 2 = 5	ounces of 23 carats.	
	24	—5	ounces of 24 carats.	

NOTE 1.—By the above operations, it will be seen, that the answers depend on the manner of connecting the different rates with each other. In some questions a number of different answers may be given, yet each of them will make the required compound. Any person, therefore, wishing to make a compound, after finding the requisite quantities by different operations, can make choice of those quantities which are found to be most profitable and convenient.

NOTE 2.—When one of the simples or ingredients of the compound possesses no value, as when water is mixed with spirits, or alloy with the precious metals, its rate is nothing, or 00, and must be placed at the top of the column of rates, and connected in the same manner as all the other prices are connected, and its difference taken and placed in the same manner.

3. A vintner mixed wines, at \$2,50, \$2,25, \$1,75, and 90 cents a gall. with enough water to make it worth \$1 a gall.; how many galls. of each kind, and how much water did he use?

{ 255 gs. of water. 125 gs. at 90 cts. 100 gs. at 175 cts. 10 gs. at 255 cts. 100 gs. at 250 cts. }	} Ans. 1.	{ 272 gs. of water. 75 gs. at 90 cts. 10 gs. at 175 cts. 100 gs. at 225 cts. 100 gs. at 250 cts. }	} Ans. 2.

{ 225 gallons of water. 275 gallons at 90 cents. 100 gallons at 175 cents. 10 gallons at 225 cents. 110 gallons at 250 cents. }	} Ans. 3.

4. How much barley, at 40 cents, rye, at 60 cents, and wheat, at 90 cents per bushel, must be mixed together, to make a compound worth 62½ cents the bushel?

Ans. 17½ bushels of barley, 17½ of rye, and 25 of wheat.

5. It is required to mix wine at 60 cents, 90 cents, and \$1.15 a gallon, with water, that the mixture may be worth 75 cents per gallon: how much of each sort must be used to make this compound? Ans. 40 gallons of water: 15 gallons of wine, at 60 cents; 15 gallons at 90 cents; and 75 gallons at \$1.15.

6. A merchant has sugars, at \$6, \$5, \$12, and \$14 per cwt.; how much of each must be mix, that the compound may be worth \$11 per cwt.

$$\left\{ \begin{array}{l} 3 \text{ cwt. at } \$6 \\ 1 \text{ cwt. at } \$5 \\ 3 \text{ cwt. at } \$12 \\ 5 \text{ cwt. at } \$14 \end{array} \right\} \text{Ans. 1.} \quad \left\{ \begin{array}{l} 1 \text{ cwt. at } \$6 \\ 3 \text{ cwt. at } \$8 \\ 5 \text{ cwt. at } \$12 \\ 3 \text{ cwt. at } \$14 \end{array} \right\} \text{Ans. 2.}$$

CASE SECOND.

Q. What is the second case in alligation alternate?

A. It is when the price of each ingredient, the quantity of one of them, and the mean rate of the whole compound, are given, to find the several quantities of the other ingredients which will make the desired mixture.

Q. What is the RULE in this case?

A. Take the difference between the several prices and the mean rate, and place them as in case first. Then by the rule of three, say, as the difference, (standing against that price whose quantity is given, : is to that quantity, :: so is each of the other differences, severally, : to the several quantities required.

EXAMPLES.

1. A wine merchant has 40 gallons of wine, at \$1 a gallon, which he wishes to mix with some at \$1.25, some at 90 cents, and some at 75 cents the gallon; how much of each kind must be put to the 40 gallons, to make a mixture worth 95 cents the gallon?

$$\text{Operation. } 95 \left\{ \begin{array}{rcl} 75 & - & 30 \text{ gallons.} \\ 90 & - & 5 \text{ "} \\ 100 & - & 5 \text{ "} \\ 125 & - & 20 \text{ "} \end{array} \right.$$

case first, we here find the number of gallons of each one, that will make the desired mixture, without any given quantity of either kind; and as 5 galls. stands to price, whose quantity is given, therefore, say

As 5 : 40 :: $\left\{ \begin{array}{l} 30 : 240 \text{ gallons, at } 75 \text{ cts.} \\ 5 : 40 \text{ gallons, at } 90 \text{ cts.} \\ 20 : 160 \text{ gallons, at } 125 \text{ cts.} \end{array} \right\}$ *Ans.*

2. How much gold, of 16, 20, and 24 carats fine, and how much alloy, must be mixed with 10 ounces, of 18 carats fine, that the composition may be 22 carats fine? *Ans.* 10 oz. of 16, 10 oz. of 20, 170 of 24 carats fine, and 10 oz. of alloy.

3. A grocer has 14 cwt. of sugar, that cost him \$14 per cwt.; but being too dear to sell readily, he wishes to mix it with some at \$10, some at \$8, and some at \$6 the cwt., and to make a composition that he can sell at \$9 the cwt. and make 50 cents the cwt.; how much of each kind must he put with his 14 cwt.?

Ans. 30½ cwt. at \$6. 8½ cwt. at \$8. 2½ cwt. at \$10.

4. A tobacconist mixed 20 lbs. of tobacco, worth 15 cts. a lb., with others, at 16 cts., 18 cts., and 22 cts. a lb.; how many lbs. of each, must he take, that the mixture may be worth 17 cts.

Ans. 4 lbs. at 16 cts. 4 lbs. at 18 cts. 8 lbs. at 22 cts.

CASE THIRD.

Q. What is the third case in Alligation Alternate?

A. It is when the prices of the several ingredients, the quantity to be compounded, and the mean rate of the whole mixture, are given, to find how much of each sort will make the desired compound.

Q. What is the RULE in this case?

A. Find the difference between the mean rate and the several prices, and place them as in case first. Then say, as the sum of all these differences : is to the given quantity : : so is each difference : to its own particular quantity.

EXAMPLES.

1. A person wishes to ship 2000 lbs. of cheese, that may average 9 cts. per lb.; he has four sorts on hand, some at 12 cts., some at 10 cts., 8 cts., and 6 cts. the lb.; how much of each sort will make up the required lot?

Operation. $9 \left\{ \begin{array}{l} 6 \text{ — } 3 \\ 8 \text{ — } 1 \\ 10 \text{ — } 1 \\ 12 \text{ — } 3 \end{array} \right.$ Then, as 8 : 2000 $\left\{ \begin{array}{l} 3 : 750 \text{ lbs.} \\ 1 : 250 \text{ " } \\ 1 : 250 \text{ " } \\ 3 : 750 \text{ " } \end{array} \right.$

Sum of the differences 8

The answer, therefore, is $\left\{ \begin{array}{l} 750 \text{ lbs. at } 6 \text{ cts.} \\ 250 \text{ " at } 8 \text{ cts.} \\ 250 \text{ " at } 10 \text{ cts.} \\ 750 \text{ " at } 12 \text{ cts.} \end{array} \right.$

2. A goldsmith wishes to make a compound of 78 ounces, of 16 carats fine; and having gold of 14, 18, and 22 carats, how many ounces of each, and how many of alloy, will make the desired composition? *Ans.* 6 oz. of 22 carats, 48 oz. of 18 carats, 18 oz. of 14 carats, and 6 ounces of alloy.

3. A grocer receives an order for 1000 pounds of sugar, at 8 cents per lb.; but having none that he can sell at that price, he mixes different qualities; some at 12 cents, some at 9 cents, and some at 6 cents per pound; how much of each kind will make the mixture? *Ans.* 555 $\frac{1}{2}$ lbs. at 6 cts., 222 $\frac{1}{2}$ lbs. at 9 cts. and 222 $\frac{1}{2}$ lbs. at 12 cts.

4. I have 4 sorts of wine; some at \$3 $\frac{1}{2}$, some at \$2 $\frac{1}{2}$, some at \$1 $\frac{1}{2}$, some at 75 cents, of which I wish to make a mixture of 136 gallons, that I can sell at \$2 a gallon; how much of each must I use? *Ans.* 51 gals. at 75 cents, 17 gals. at \$1 $\frac{1}{2}$, 25 $\frac{1}{2}$ gals. at \$2,50, and 42 $\frac{1}{2}$ gals. at \$3,50 cts.

POSITION.

Q. What is Position, or what does it teach?

A. It teaches, by taking false or supposed numbers, and proceeding with them according to the directions of the questions, to find the true ones required; and is divided into two parts, single, and double position.

SINGLE POSITION.

Q. What is Single Position, and what does it teach?

A. Single position is when the results of the operation are proportional to their supposition. It teaches to solve those questions that require the multiplication or division of the number sought, by any proposed number; or to be increased or diminished by itself a certain number of times.

Q. What is the RULE for single position?

Make any convenient number and perform the same operation on it, as if it were the true one; then say, as the result of this operation : is to the given sum, in the question : so the supposed sum : to the true one required.

EXAMPLES.

1. A's age is double that of B., and B.'s age is triple that of C., and the sum of all their ages is 140; what is the age of each?

Operation. Suppose C.'s age to be 25 years.

Then C.'s age $\times 3 = B.'s = 75$

B.'s age $\times 2 = A.'s = 150$

250 sum of their ages.

Then as 250 : 140 :: 25 : 14 = C.'s age.

Then C.'s age being 14 years,

$14 \times 3 = 42 = B.'s$ age. $42 \times 2 = 84 = A.'s$ age.

Proof; $14 + 42 + 84 = 140$ sum of all their ages.

2. A person being asked how much money he had in his purse, replied, that if $\frac{2}{3}$ of the sum were multiplied by 7, and $\frac{1}{3}$ of the sum were added to the product, the amount would then be \$292; how much had he in his purse? *Ans.* \$60.

3. A boy being asked how many marbles he had, said that if $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$, were added to the number, he should then have 125; how many had he? *Ans.* 60.

4. A general, in a disastrous engagement, had $\frac{1}{2}$ of his army taken prisoners, one third of them killed and wounded, and 700 remaining unhurt; what number of men did he command?

Ans. 4200 men.

5. A gentleman collected \$78, to be distributed among a company of Irish emigrants, consisting of men, women, and children; to each man, he gave \$6, to each woman he gave \$4, and to each child, \$2, there were twice as many women as men, and three times as many children as there were women; how many were there of each?

Ans. 3 men, 6 women, and 18 children.

6. A. B. and C. bought a quantity of goods, which cost them \$360; they agreed to divide them so, that A., should have a certain portion, that B. should have $\frac{1}{2}$ more than A. and that C. should have $\frac{1}{3}$ more than B., and that each should pay in that proportion; what proportion of the goods had each, and how much did each pay for his share?

Ans. A. had $\frac{1}{4}$, cost \$90. B. $\frac{1}{3}$, cost \$120. C. $\frac{5}{12}$, cost \$150.

7. What number is that, which being increased by its half, its third, and its fourth, the sum will be 160? *Ans.* 76,8.

8. A man having bated a flock of pigeons, set his net to catch them; the first day he caught one fourth of the flock, the second day he caught one third of the remaining part, the third day he caught one half of the residue, and the fourth day he caught 60, which comprised the whole flock; how many did the whole flock contain? *Ans.* 240

DOUBLE POSITION.

Q. What is Double Position ?

A. It is when the number sought is increased or diminished by some given number, which is no known part of the number required, and includes those questions, whose results are not proportioned to their positions.

Q. How do you solve questions in this rule ?

A. By supposing two false numbers, and proceeding with them as the question directs, and from their result the true number is found.

Q. What is the RULE in double position ?

A. Take any convenient number, and proceed with it exactly as if it were the true number, and find the result ; then find the difference between this result and the given sum in the question, and call it the first error. Next, suppose another convenient number, either greater or less than the first, and proceed with it as before, and call the difference between this second result and the given sum, the second error. Then multiply the first supposition into the second error, and the second supposition into the first error, and, if your errors are alike, divide the difference of these products, by the difference of the errors ; but if the errors are unlike, divide the sum of the products, by the sum of the errors, and in either case the quotient will be the answer, or number sought.

Q. When are the errors said to be alike or unlike ?

A. They are alike, when both the suppositions are either greater or less than the true number ; they are unlike when one of the suppositions is greater, and the other is less than the true number required in the question.

EXAMPLES.

1. A shrewd boy being asked how old he was, replied ; 8 years ago, I was only one third as old as my father was at that time, but now, I am half as old as my father is at the present time ; what was the age of the father and son ?

Ans. The father's age, 32 years. Boy's, 16 years.

2. A boy, carrying some eggs to market, was asked how many he had to sell, to which he replied that he did not know exactly, but his father told him, if one dozen were added to the number, and that sum divided by 2, and this quotient multiplied by 4, and two dozen added to this product, and the whole sold for 12½ cents a dozen, he would have \$1.50 for me ; how many eggs had he to sell ? **Ans.** 4 dozen

3. A drover, going to market with a drove of calves, sheep, and hogs, was met by an inquisitive fellow, who was very anxious to know how many animals he had in his drove, to whom he replied, that he should not tell him how many he had, but that he had made this calculation upon them; that his whole drove cost him \$400; that $\frac{2}{3}$ of his drove were sheep; $\frac{1}{3}$ of the residue were hogs; and the remainder were calves; and, that if he could sell his sheep for \$2 $\frac{1}{2}$ a head, his hogs for \$3 $\frac{1}{2}$, and his calves for \$5 a head, he should make \$119 by his speculation; how many of each kind had he in his drove?

Ans. 60 sheep, 54 hogs, and 36 calves.

4. A butcher bought at one time, 20 sheep, and 30 lambs, for which he gave \$120; he afterwards bought 30 sheep, and 25 lambs, at the same price as before, which amounted to \$140; what was the price paid for each sheep, and how much for each lamb? *Ans.* For each sheep, \$3, and each lamb \$2.

5. A gentleman has two horses, a black and a grey, and a chaise worth \$150; if the black horse be put in the chaise, they will, together, be worth twice as much as the grey; but if the grey horse be put in the chaise, they will be worth three times as much as the black; what is the value of each horse?

Ans. The black is worth \$90, and the grey \$120.

6. A boy, who had been stealing peaches, was caught by B. and to appease his anger, the boy gave him half he had, lacking 10; going farther, he met C. who took half he had left, lacking 4; after this he met D. who took from him half he had left, lacking 1; at length, getting safe away, he finds he has only 13 left; how many had he at first? *Ans.* 60.

7. There is a building, the posts of which are 14 feet in length; the width is equal to the height and half the length of the building, and the length is equal to the width and height added together; what are the dimensions of the building?

Ans. 56 feet long, and 42 feet wide.

8. A man driving a flock of live geese to market, was met by a fellow, who thus accosted him: "Good morning, my friend, with your five hundred geese." "Ah!" said the man, "if you are a yankee, you have not guessed right this time. But I'll tell you what, if I had the flock of wild geese I saw in the pond, just back, I should then have 4350." "Indeed!" said the fellow, "why, how many did you see?" "I do n't know how many," said the man, "but I counted as many again as I have in my flock, my partner counted as many again as I did, and my son counted as many again as my partner, and yet we counted but just half the flock. Now, if you can tell how many geese I have in my flock, I will venture to give you one. How many had he?" *Ans.*

9. A market woman carried her butter, strawberries, and eggs, to market; she sold her butter for 25 cents a pound, her strawberries at 20 cents a quart, and her eggs, at 15 cents a dozen, and the whole amounted to \$7.65 cents; if the number of dozens of eggs were added to the number of quarts of strawberries, the sum would be equal to the number of pounds of butter; but if the pounds of butter were added to either of the other articles, the sum would be just three times as much as the remaining one; what was the quantity of each article?

Ans. 18 lbs. of butter. 9 qts. of strawberries. 9 doz. of eggs.

10. A sheepfold was robbed three nights in succession; the first night, half the sheep, and half a sheep over, were taken; the second night, half the remainder, and half a sheep over, were taken; the third night, they took half that were left, and half a sheep over; the owner now found he had but 20 sheep left; how many had he at first?

Ans. 161.

11. Says A. to B., "You have a fine flock of sheep; I should like to purchase 25 of them, I should then, I think, have as many as you would." "No, says B. I had rather purchase 30 of your sheep, and then I should have just three times as many as you would;" how many sheep did each own?

Ans. A. owned 135. B. owned 85.

GEOMETRY.

Q. What is Geometry?

A. It is a science which treats of all kinds of bodies, delineates their shape or figure, and teaches to measure their superficial and solid contents; as, to measure boards, timber, casks, boxes, cisterns, land, &c. &c.

Q. What is the first thing to be attended to, in the study of geometry?

A. The first thing, necessary to be learned, in obtaining a competent knowledge of geometry, is the definition of those terms which are of most frequent occurrence; such as points, lines, angles, squares, circles, and the various kinds of geometrical figures.

[F] As the object here is, merely to give the scholar so much knowledge of geometry as to enable him to measure superficies and solids, with facility and accuracy, such definitions only will be given, as are necessary for the accomplishment of that object.

GEOMETRICAL DEFINITIONS.

Q. What is a point, in geometry, or mathematics?

A. A point is considered without regard to dimensions, and is merely a mark, or dot, at which to commence the measurement of any surface or distance.

Q. What is a line?

A. A line is considered as having length, but neither breadth nor thickness.

Q. What is a superficies or plane?

A. It is a surface, having length and breadth, without regard to thickness.

Q. What is a solid?

A. It is a body having length, breadth and thickness, as a solid block of wood or stone.

Q. How many kinds of lines are there?

A. There are two kinds of lines, straight, and crooked.

Q. What is a straight line ?

A. It is a direct line between two points, and is the shortest line that can be drawn between those points, and is also called a right line. 

Q. What is a crooked, or curved line ?

A. It is a line, whose ends verge or incline towards each other, and if continued would meet and form a circle. 

Q. In what other particulars are lines distinguished each other ?

A. All lines, in regard to each other, are either parallel, perpendicular, oblique, or diagonal ; as compared with other lines, they are distinguished by horizontal and vertical lines.

Q. What are parallel lines ?

A. They are two lines, whose ends are exactly at an equal distance from each other, and if extended to any length, would never meet. 

Q. When are lines perpendicular to each other ?

A. One line is perpendicular to another, when it does not lean towards either end, or when they meet in such a manner as to make a square corner.

Q. When are lines oblique to each other ?

A. When they are drawn so as to be neither parallel nor perpendicular to each other, but slant either towards or from each other. 

Q. What is a diagonal line ?

A. It is a line drawn from one corner of a plane or superficies, to the other corner. 

Q. What is a horizontal line ?

A. It is a line drawn parallel to the horizon, or on the surface of the earth.

Q. What is a vertical line ?

A. It is a line drawn perpendicular to a horizontal line. Any body that stands upright, as a steeple, is said to be vertical. 

a square ?
ure, having four equal sides, meeting
ndicularly, which make the corners 

Q. What is a parallelogram, or long square ?

A. It is a four sided figure, having its opposite sides equal, and meeting each other perpendicularly, like a square.



Q. What other regular four sided figures are there ?

A. Rhombs, Rhomboids, and Trapezoids, besides various others of an irregular form.

Q. What general name will comprehend all other four sided figures ?

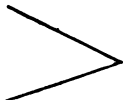
A. They are all included under the general name of Trapezium.

Q. What general name will include all figures of more than four sides ?

A. They are all comprehended under the name of Polygon. If they are of equal sides, they are called regular polygons. If their sides are unequal, they are called irregular polygons.

Q. What is an angle ?

A. It is a point where two lines meet in such a manner as to include a space between them.



Q. How many kinds of angles are there ?

A. Three ; right angles, acute angles, and obtuse angles.

Q. What is a right angle ?

A. It is an angle, made by two lines meeting each other perpendicularly, and making a square corner.

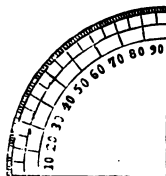


Q. How is the magnitude of an angle determined ?

A. Angles are measured or determined by the number of degrees contained between the lines that form them.

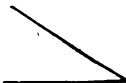
Q. How many degrees are contained in a right angle ?

A. Every right angle contains 90 degrees, or one fourth part of a circle, whether the space included between the sides is great or small.



Q. What is an acute angle ?

A. It is an angle less than a right angle ; that is, containing less than 90 degrees.



Q. What is an obtuse angle ?

A. It is an angle larger than a right angle ; that is, containing more than 90 degrees.



Q. What is meant by an oblique angle ?

A. All angles, either greater or less than a right angle, are called oblique angles.

Q. What is the least number of right lines, necessary to enclose a space, and what is the figure, formed by them, called ?

A. Three lines are necessary, and the figure, formed by them, is called a triangle.

Q. How many kinds of triangles are there ?

A. There are three kinds, viz : Equilateral Triangles, Isosceles Triangles, and Scalene Triangles.

Q. What is an Equilateral Triangle ?

A. It is an angle of three equal sides.



Q. What is an Isosceles Triangle ?

A. It is an angle of two equal sides, and having the other longer or shorter.



Q. What is a Scalene Triangle.

A. It is an angle, having all three of its sides unequal.



Q. How many angles are contained in every triangle ?

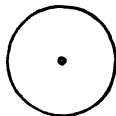
A. Three, viz.: One right angle, and two acute ; or one obtuse angle, and two acute ; or three acute angles.

Q. How many degrees are contained in the three angles of every triangle ?

A. One hundred and eighty degrees, or half a circle.

Q. What is a circle ?

A. It is a round figure or ring, bounded on all sides by a line, equally distant from a point within, called the centre.



Q. Into how many equal parts is every circle supposed to be divided ?

A. Every circle, whether great or small, is supposed to be divided into 360 equal parts, called degrees. Each degree is also subdivided into 60 minutes, and each minute into 60 seconds.

MENSURATION OF SUPERFICIES.

Q. What is meant by Superficial Measure ?

A. The measurement of the surface or outside of any body, as of a piece of land, the outside of a building, of painting, paving, &c.

Q. How are superficies or surfaces measured ?

A. By the superficial foot, yard, rod, or acre, according to the measure of different artificers.

Q. How are the superficial contents of every surface found ?

A. By the proper rule of its figure, whether square, triangular, or circular.

ARTICLE I. TO MEASURE A SQUARE AND PARALLELOGRAM.

Q. What is the RULE for finding the superficial contents of a square of equal sides ?

A. Multiply the length of one side into itself, and the product will be the superficial contents or area, in the same denomination of the given sides, which must be brought to the denomination required.

Q. How do you find the superficial area of a parallelogram, or long square ?

A. Multiply the length by the breadth, and the product will be the superficial area as before.

EXAMPLES.

1. There is a garden, laid out in an exact square, measuring, on each side, 160 feet ; how many square yards does it contain ?

Operation. $160 \times 160 = 25600 \div 9 = 2844\frac{4}{9}$ yds. *Ans.*

2. There is a farm, lying in the form of a parallelogram, measuring 240,5 rods in length, and 87,5 rods in width ; how many acres does it contain ? *Ans.* 131 acres, 2 roods, 3 rods.

3. How many feet of boards will lay the floor of a room, measuring 16 by 18 feet ? *Ans.* 288 feet.

4. A man bought a tract of land, measuring 320 rods in length, and 175 rods in breadth, at \$12 $\frac{1}{2}$ an acre ; how many acres did it contain, and what was the amount of his purchase ?

Ans. 350 acres. Amount, \$4375.

ARTICLE II. TO MEASURE A RHOMBUS AND RHOMBOID.

Q. What is a Rhombus ?

A. It is a figure in the form of a diamond, having four equal sides, its opposite angles being equal ; two of which are greater, and two less than the angles of a square.

U*

Q. What is a Rhomboid ?

A. It is a four sided figure, whose opposite sides and ends are equal, but meeting each other obliquely, making two of its angles greater, and two less than those of a parallelogram.

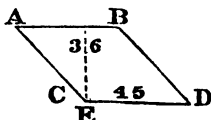


Q. What is the RULE for finding the superficial area of a Rhombus, or of a Rhomboid ?

A. Multiply the length of one side by the perpendicular width of the figure ; as the dotted lines across the figures, in the following examples.

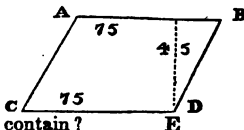
EXAMPLES.

1. Let the annexed figure, A B C D represent a field of four equal sides, measuring 45 rods, each ; the dotted perpendicular, E measures 36 rods ; how many square rods are contained in the field ?



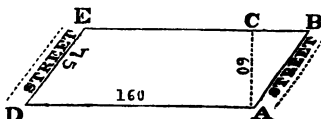
Ans. $45 \times 36 = 1620$ square rods.

2. Let the annexed rhomboidal figure represent a field, whose sides, A B and C D, measure 75 rods, and whose perpendicular width, E, is 45 rods ; how many rods, and how many acres does it contain ?



Ans. 3375 rods = 21 acres, 15 rods.

3. There is a lot, lying between two streets, which run in such direction as to bring it into the form of a rhomboid ; the lot is 160 feet deep, and measuring from corner A to B, and also, from corner D to E, the distance is 75 feet ; but the perpendicular distance, A C, measures but 60 feet ; how many square feet less are there in the lot, than there would be, if it lay in an exact parallelogram of 75 feet in width ?

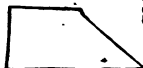


Ans. It contains 2400 feet less.

TITLE III. TO MEASURE A TRAPEZOID.

Trapezoid ?

sided figure, having its sides equal ; and its ends equal, and two of its angles greater
a 90 degrees.

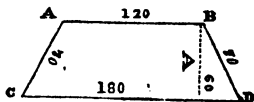


Q. What is the **RULE** for measuring a Trapezoid?

A. Add the length of the two longest sides together, and multiply the sum by the perpendicular breadth, and half the product will be the answer.

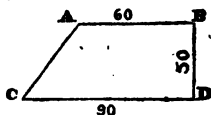
EXAMPLES.

1. In a lot of land described by the figure A B C D, the line A B, is 120 rods; the line C D, is 180 rods; the two lines A C, and B D, are 70 rods; but the dotted perpendicular A, is but 60 rods; how many acres are contained in the lot, and how many acres would there be, if the lines A C, and B D, were raised perpendicular to C D, and the line A B, extended to them?



Ans. { It now contains $56\frac{1}{2}$ acres.
It would contain $78\frac{1}{2}$ acres.

2. A garden, lying in the form of the annexed figure, measures as follows: the line A B, 60 feet; the line C D, 90 feet; and the end B D, 50 feet; how many square feet, and square yards does it contain?



Ans. 3750 ft. and $416\frac{2}{3}$ square yds.

3. How many feet in a board 24 feet, 6 inches long; 2 feet, 4 inches wide, at one end, and 16 inches wide at the other?

Ans. 44 feet, 11 inches.

ARTICLE IV. TO MEASURE TRIANGLES.

Q. What are the three sides, that enclose a right angled triangle, called?

A. They are called the Base, the Perpendicular, and the Hypothenuse. The base and perpendicular are also called legs.

Q. Which is the base of a triangle?

A. The longest side, in all oblique angles, is called the base. In a right angled triangle, the longest side is called the hypothenuse, and the longest of the two legs is called the base, and the shortest leg is called the perpendicular.

Q. What is the perpendicular in all oblique angles?

A. It is a line drawn perpendicularly to the base, from the angle opposite to the base.

Q. What known proportion do the sides of right angles bear to each other?

A. The square of the hypotenuse is always equal to the sum of the squares of the other two legs ; therefore, by having any two sides of an angle given, the other is easily found.

Q. When the two legs of a right angled triangle are given to find the hypotenuse, what is the RULE ?

A. Square each given side, and add them together, then extract the square root of this sum and you will have the length of the hypotenuse, in the same denomination of the given sides.

Q. When the hypotenuse, and one of the legs are given to find the other leg, what is the RULE ?

A. Subtract the square of the given leg, from the square of the hypotenuse, and the remainder is the square of the unknown side ; extract the square root of this remainder, and you will have the length of the required side.

Q. How do you find the superficial contents or area of a right angled triangle ?

A. Multiply the base and perpendicular together, and half the product will be the area or contents.

Q. How can you measure an oblique angled triangle, as an isosceles, or scalene triangle ?

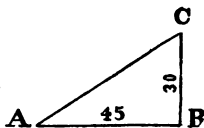
A. Multiply the base, by a perpendicular, let fall upon the base, from the angle opposite to it, and half the product will be the answer. Or in measuring any angle, multiply the base by half the perpendicular, or the perpendicular by half the base, and the product is the area.

Q. What reason can you give for this RULE of measuring triangles ?

A. Every triangle is just one half of a square, or a parallelogram, of equal base and perpendicular height ; and as in measuring those figures we multiply the length by the breadth, it is evident, that to measure an angle, which contains just one half of a square, or of a parallelogram, we must multiply one half of the length by the breadth ; or, if the whole length and breadth are multiplied together, it must also be evident, that half the product will be the area of the angle.

EXAMPLES.

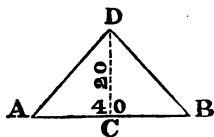
1. In the annexed right angled triangle, the base A B, is 45 rods ; the perpendicular B C, is 30 rods ; what is the length of the hypotenuse, A C, and how many square rods does the angle contain ?



{ Hypotenuse 54 rods +.
 { Superficial area 675 rods.

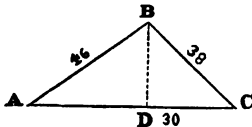
2. In the annexed angle, the base A B, is 40 rods; the perpendicular C D, is 20 rods; what is the length of the sides, A D and B D, and how many square rods does it contain?

Ans. The lines A D, and B D, 28,28 rods. Superficial area 400 rods.



3. In the annexed angle, the line A B, is 46 rods; the line B C, is 38 rods, and the line D C, is 30 rods; what is the perpendicular height from D to B, and also, what is the distance from A to D, and how many acres are contained in the whole triangular field?

Ans. Perpendicular B D, 23,32 rods. The distance A D, 39,64 rods. Superficial area, 5 acres, 12 rods.



4. An eagle, sitting on the top of a tree, measuring 144 feet in height, was shot by a boy, from behind a wall, 48 yards distant from the root of the tree; how many yards distance did the boy shoot?

Ans. 67 yds. 3 qr. 2 na.

5. Two ships part at sea, one sails due north, 64 leagues, the other due west, 81 leagues; how far are the two ships from each other?

Ans. 103 leag. 0 m. 5 fur. 22 rds. 4 yds. nearly.

6. If a house be 36 feet wide, how long must the rafters be, to make the perpendicular height of the roof 16 feet; and how many square feet, are contained in each gable end of the house?

Ans. Length of rafters, 24,08 feet. Area of each end, 288 ft.

7. There is a well 6 feet in diameter, and the post which supports the sweep, is 20 feet high, and stands 16 feet from the curb of the well, the top of which is 3 feet from the ground; what length of well-sweep, will it require, if hung in the centre, for the end of the sweep, when drawn down, to strike the centre of the curb?

Ans. 50,98 feet.

SUPPLEMENT TO ARTICLE FOURTH.

Q. In what proportion does the width of a triangle decrease, as you recede or measure from the base?

A. The width of a triangle decreases in exact proportion to the perpendicular distance from the base.

Q. If the length of the base and the width of the angle, a certain distance from the base, be given, how can you find the length of the whole perpendicular, from the base to the opposite angle, or the distance from the base to the point, where the other two sides meet?

A. By the rule of three; say, as the decrease of the angle, at a given distance from the base : is to that distance : : so is the length of the base : to the whole perpendicular of the angle, or to the point, where the two sides will meet.

Q. Having the area of a triangle, and the length of the base given, how can you find the perpendicular?

A. Divide the area by half the base, and the quotient will be the perpendicular : or, if you divide the area by half the perpendicular, the quotient will be the base.

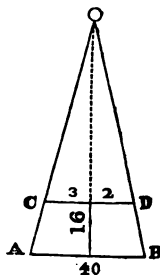
EXAMPLES.

1. In the annexed angle, the base A B, is 40 rods; the diameter C D, is 32 rods; and the perpendicular distance from A B, to C D, is 16 rods; what is the length of the whole perpendicular, or to the point o, where the two sides meet?

Operation.

$40 - 32 = 8$ the decrease at C D.

Then as $8 : 16 :: 40 : 80$ the whole perpendicular, or answer, 80 rods.



2. If the base of an angle be 140, and at the perpendicular distance of 35, the width be 124, what is the length of the perpendicular?
Ans. 306 $\frac{1}{2}$.

3. A surveyor, in laying out a new road, came to a river and marshy ground that he could not pass, the distance across which he must necessarily ascertain. He therefore takes a station at A, and observing a large tree on the opposite side, measures in a direct line towards it, to the margin of the marsh, 20 rods, to D; he then measures off from A to B, 16 rods; from B, he ranges towards the tree, and sticks a stake at O; on measuring from O to D, he finds the distance to be 10 rods; it is required to find the distance across the river and marsh, from D to the tree?

Ans. 33 $\frac{1}{2}$ rods.



4. It is required to lay out a garden in the form of a right angled triangle, the area of which shall be 864 yards, and the base 48; what must be the length of the perpendicular, and hypotenuse? *Ans.* Perpendicular, 36 yds. Hypotenuse, 60.

5. A surveyor, in running and measuring a line between two towns, is interrupted by a pond of water; he therefore measures directly back from the edge of the water, 36 rods; and ranges to, and notes an object on the opposite side of the pond; he then measures off, perpendicularly to this line, 36 rods, and ranging to the same object on the opposite side of the pond, he measures directly towards it, to the water's edge, when he finds the distance from this station, to the first one, to be 28 rods; what is the distance across the pond? *Ans.* 126 rods.

ARTICLE V. TO MEASURE REGULAR POLYGONS.

Q. What are Regular Polygons?

A. They are figures, whose sides and angles are all equal, and denominated from their number of sides, which are from 5 to 12, and sometimes more.

Q. How can you form a regular polygon of any given number of sides?

A. Draw a circle of the diameter of the required polygon, and divide the circumference into as many equal parts as the polygon has sides, and the quotient will show the length of each side, which may be set off and marked accordingly.

Q. What is the RULE for finding the area of a polygon?

A. Multiply the length of one of the sides, by the number of sides, then multiply this product by the length of a perpendicular, drawn from the centre of the figure, to the middle of one of the sides, and half the product will be the area of the polygon.

EXAMPLES.

1. In the annexed 6 sided polygon, the sides are 44 inches, the perpendicular A B, is 40 inches; what is the area?

$$44 \times 6 = 264$$

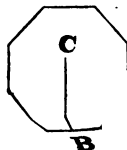
Then $264 \times 40 \div 2 = 5280$ inches.

Then $5280 \div 144 = 36\frac{2}{3}$ feet *Ans.*



2. In the annexed 8 sided polygon, the sides are 45 rods, and the perpendicular B C, measures 56 rods; what is the superficial area, in acres?

Ans. 63 acres.



ARTICLE VI. TO MEASURE A CIRCLE AND ITS PARTS.

Q. What particular parts are necessary to be noticed in a circle ?

A. The Circumference, the Diameter, and the Radius or Semidiameter.

Q. What is the circumference of a circle ?

A. It is the curve line that forms it, or the distance round it.

Q. What is the diameter of a circle ?

A. It is a straight line, passing through its centre from one side to the other, and is the longest straight line that can be drawn in it.

Q. What is the radius, or semidiameter of a circle ?

A. It is a line drawn from the centre to the circumference, or half the diameter.

Q. What proportion does the diameter of a circle bear to its circumference ?

A. The diameter bears the same proportion to its circumference, that 7 bears to 22 ; or (which is a little more exact) that 113 bears to 355.

Q. If the diameter of a circle be given, how do you find the circumference ?

A. By the rule of three ; say, as 7 : 22 or as 113 : 355 :: so is the diameter to the circumference.

Q. If the circumference be given, how do you find the diameter ?

A. Change the order of the proportion, and say, as 22 : 7 or as 355 : 113 :: so is the circumference to the diameter.

Q. Having the circumference and diameter of a circle given, by what RULE do you find its area ?

A. Multiply half the circumference by half the diameter, and the product will be the area.

Q. If the diameter alone be given, how can you find the area, without finding the circumference ?

A. Square the diameter, and multiply this square, by the decimal, .7854, and the product will be the area.

Q. If the circumference alone be given, how can you find the area, without finding the diameter ?

A. Multiply the square of the circumference by the decimal, .07958, and the product will be the area.

— The following short rules will be found sufficiently common purposes, and convenient in many instances, for the instructor and scholar, as well as for others; viz.:

1. The diameter of a circle be multiplied by the decimal .7854, the product will be the side of a square of equal area.

2. If the circumference of a circle be multiplied by ,318, the product will be the diameter.
3. If the circumference of a circle be multiplied by ,282, the product will be the side of an equal square.
4. If the side of any square be multiplied by 1,128, the product will be the diameter of a circle of equal area.
5. If the area of any figure be multiplied by 1,273, the square root of the product will be the diameter of an equal circle; or extract the square root of the area, and multiply this root by 1,128, and the product will be the diameter.

EXAMPLES.

1. If the diameter of a circle be 14 inches, what is the circumference, and what the area?
 $\text{As } 7 : 22 :: 14 : 44 \text{ inches, the circumference.}$
 Then half the circumference is 22
 Half the diameter is 7

Ans. 154 inches area.

2. If the circumference of a circle be 154, what is its diameter, and superficial area? *Ans.* Diameter 49. Area 1886 $\frac{1}{2}$.
3. There is a circular field, whose diameter is 44 rods; how many rods of fence will enclose it, and if planted with corn, and were to yield 35 bushels to the acre, how many bushels would it produce? *Ans.* It will require 138 $\frac{1}{2}$ rods of fence. It would yield 332 bushels, 3 pecks.

4. The arms of a wind-mill are 24 $\frac{1}{2}$ feet, from the centre of motion, to their extremities; how large a circle do they describe in their rotation, and how many yards of canvas, $\frac{1}{4}$ of a yard wide, would cover the whole surface? *Ans.* They will describe a circle 154 ft. circuit, and it would require 279 yds. 1 qr. 3 $\frac{1}{2}$ nails.

5. There is a wheel, 4 feet in diameter; what must be the diameter of another wheel, whose circumference is just twice as much; and what proportion do their areas bear to each other? *Ans.* The second must be 8 feet diameter, and the area of it, just 4 times as much.

6. The diameter of the annexed outer circle is 32 inches; it is required to draw a circle within it, which shall enclose just one half of its area; what must be its diameter?

Ans. 22,62 inches.



7. There is a square whose side measures 64 inches is the diameter of a circle, that will contain the same
Ans. 72 in

8. A gentleman has a garden containing 144 square rods, and wishes to lay out a circle in the centre, that shall contain just $\frac{1}{4}$ of the whole area; what must be the diameter of the circle?

Ans. 6,769+ rods.

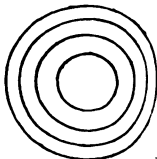
9. There is a square meadow, containing 8 acres; if a man commence mowing in the centre, and mows round in a circle, how many rods in diameter must he mow, to cut down one half the meadow?

Ans. 28,5+ rods.

10. There is a cubic cistern, containing 2500 gallons, and a gallon measure is computed to contain 231 cubic inches; what must be the diameter of a round cistern, of equal depth, to contain the same quantity?

Ans. 7 ft. 10 inches.

11. There is a circle, 60 inches in diameter; it is required to draw three circles within it, that shall divide it into four equal parts; what will be the diameter of each inner circle? *Ans.* Diameter of the smaller circle, 30 inches. Diameter of the second circle, 42,42. Diameter of the third circle, 51,96.

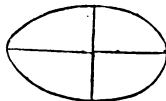


¶ The area of circles are to each other, as the squares of their diameters. When the diameter is 1, the area is found to be ,7854 decimal. Therefore it is, that the square of the diameter, multiplied by the decimal ,7854, gives the area of any circle.

ARTICLE VII. TO MEASURE AN ELLIPSIS OR OVAL.

Q. What is an ellipsis or oval?

A. It is a long circular figure, having two unequal diameters, as seen in the annexed figure.



Q. How are the two diameters of an ellipsis distinguished?

A. The longest diameter is called the transverse, and the shortest is called the conjugate diameter.

Q. How do you find the area of an ellipsis?

A. Multiply the two diameters together, then multiply the product by the decimal ,7854, and the last product will be the area.

EXAMPLES.

If the two diameters of an ellipsis are 24 and 36 feet, what is its area?

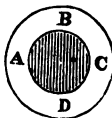
Ans. 678 feet, 7 inches.

2. The two diameters of an ellipsis are 16 and 24 feet; what is its area, and what must be the diameter of a circle whose area shall be equal? *Ans.* Area of the ellipsis, 301 feet, 7 in. Diameter of an equal circle, 19 ft. 7 in. $\frac{1}{2}$.

3. The transverse diameter of an ellipsis is 48 inches, and the conjugate diameter 36 inches; what is its area, and what must be the diameter of a circle of equal area? *Ans.* The area of the ellipsis, 1357,1712 $\frac{1}{2}$ in. Diameter of an equal circle, 41,569 $\frac{1}{2}$ in.

Q. How would you measure a circular ring, as A B C D?

A. Find the area of each circle, separately, and then subtract the area of the less circle from the greater, and the remainder will be the area of the ring.



ARTICLE VIII. TO MEASURE A CUBE AND PARALLELOPIPEDON.

Q. What is a solid body?

A. It is a body of three dimensions, viz.: length, breadth and thickness.

Q. How are solid bodies measured?

A. They are measured by the solid inch, foot, or yard.

Q. What is a cube or cubic body?

A. It is a solid body, of six equal sides, each of which, of itself, is an exact square, as a square box or block.

Q. What is a parallelopipedon?

A. It is a body, whose sides and ends are square, but extending in length, more than in breadth, as a square stick of timber, or a box, that is longer than it is broad or deep.

Q. How do you find the superficial area of a cube?

A. Square the given side, then multiply the product by 6, (the number of sides,) and the last product will be the area.

Q. How do you find the solid contents of a cubic body?

A. Cube the given side; that is, multiply the given side into itself, and that product by the same side, and the last product will be the solid contents.

Q. How do you find the superficial area of a parallelopipedon, or of any solid, having length, breadth, and depth, as a long box, or chest, &c.

A. Find the area of each side and end, as you would find the area of a square or parallelogram; then add all these areas together, and the sum will be the whole area required.

Q. How do you find the solid contents of any body, having length, breadth, and thickness, as a stick of timber, or plank, &c.

A. Multiply the length by the breadth, and that product by the depth or thickness, and the last product will be the solid contents.

Q. What particular RULE is to be observed in the measurement of all superficies and solids?

A. In measuring superficies, if inches are multiplied by feet, or feet by inches, the product must be divided by 12, to bring it to square feet. In measuring solids, if feet are multiplied by inches, or inches by feet, the product must be divided by 144, to bring it to solid feet.

EXAMPLES.

1. What is the superficial area of a cubic box, whose sides are $4\frac{1}{2}$ feet, and how many solid feet does it contain?

Operation. $4,5 \times 4,5 \times 6 = 121\frac{1}{2}$ ft. superficial area.

Then $4,5 \times 4,5 \times 4,5 = 91,125$, or $91\frac{1}{8}$ solid feet.

2. How many feet of boards will make a box, 6 ft. long, 4 ft. wide, and 3 ft. deep; and how many bushels will it contain, allowing a bushel measure to contain 2150 cubic inches?

Ans. { It will require 108 feet of boards.
It will contain 57 bu. 3 pk. 3- $\frac{1}{4}$ qts.

3. How many feet of boards will make a corn-bin, 24 feet long, 8 feet wide, and 4 feet deep, (without a top cover,) and how many solid feet will it contain; also, how many bushels will it contain, the bushel measure containing exactly 2150,4 inches? Ans. 448 feet of boards; 768 solid feet. 617,14 bush.

4. How many solid feet in a stick of timber 24 feet long, 16 inches one way, and 14 inches the other? Ans. $37\frac{1}{3}$ ft.

5. The grand Erie Canal is about 365 miles long, 30 feet wide, and 4 feet deep; allowing the excavation of it to cost, on an average, $12\frac{1}{2}$ cents the cubic yard, what was the expense of that portion of the labor, and what weight of water will it require to fill the whole length of the canal, to the depth of 3 feet, 6 inches, allowing a cubic foot of water to weigh $62\frac{1}{2}$ lbs.? Ans. Expense of excavation. \$1,070.666 $\frac{2}{3}$. Weight of water, allowing 2000 lbs. to the ton, is 6,323,625 tons.

6. A man was hired to dig a cellar, 30 feet in length, 24 feet in breadth, and 6 feet deep, at the rate of $6\frac{1}{4}$ cents the cubic yard; how many solid feet did the excavation contain, and to what did his labor amount, at that rate? Ans. 4320 solid feet. \$10 amount of labor.

7. There is a large pond, measuring two miles square; if feet could be drawn from the surface, how many cubic feet would be drawn off, and how many tons would it weigh? Ans. 334,540,800 tons weight.

ARTICLE IX. TO FIND THE NUMBER OF WINE GALLONS IN A ROUND OR CYLINDRICAL CISTERN.

Q. What is the RULE to find the number of wine-gallons in a round, or cylindrical cistern.

A. Square the diameter (in inches) and multiply this product by the depth (in inches). Then multiply this product by 34, and from the right hand of the product, cut off four figures; then the figures standing at the left hand of the cut-off will show the number of wine gallons.

Q. When the cistern is smaller at the top, than it is at the bottom, what is the RULE?

A. Multiply the greater diameter by the less, both in inches, and to this product, add $\frac{1}{3}$ of the square of the difference of the two diameters, then multiply this sum by the depth, and this last product by 34, and cut off 4 figures as before, and you will have the answer.

EXAMPLES.

1. How many wine gallons are contained in a cistern, 6 feet in diameter, and 8 feet deep?

Ft. in.

Operation. $6=72 \times 72 \times 96 \times 34=1692,0576$ or 1692 gallons.
 $8=96$

2. If the bottom diameter of a cistern be 4 feet, and the top diameter 3 feet, and 5 feet deep, how many wine gallons will it contain? *Ans.* Diameters 4 ft.=48; then $48 \times 36=1728$ and $48-36=12$ difference. Diameters 3 ft.=36; then $12 \times 12 \div 3 + 1728=1776$; therefore, depth 5 ft. 60; $=1776 \times 60 \times 34=362,3040$ or 362,3 gallons.

3. What is the difference in capacity of two cisterns, one measuring 48 inches in diameter at each end, and 70 inches deep, and the other 48 inches at the bottom, 28 inches at the top, and 70 inches deep? *Ans.* 196,7 gallons.

ARTICLE X. TO MEASURE A SPHERE OR GLOBE.

Q. What is a Sphere or Globe?

A. It is a round, solid body, whose surface is every where equally distant from a point within, called the centre, as a cannon ball, or any other round ball.

Q. How do you find the superficial area of a globe?

A. RULE 1.—Multiply the circumference of the globe by the diameter, and the product will be the area.

RULE 2.—Square the diameter, and multiply this square by 3,1416, and the product will be the area.

RULE 3.—Square the circumference, and multiply this square by the decimal ,3183, and the product will be the area.

Q. How do you find the solid contents of a globe?

A. **RULE 1.**—Multiply the square of the diameter by the circumference, and divide this product by 6, and the quotient will be the solid contents.

RULE 2.—Multiply the superficial area by the diameter, and divide the product by 6, for the solidity.

RULE 3.—Cube the diameter, and multiply it by the decimal ,5236, or cube the circumference, and multiply it by the decimal ,01688, for the solid contents.

EXAMPLES.

1. If a cannon ball be 9 inches in diameter, what is its circumference, its superficial area, and solid contents? *Ans.* Circumference $28\frac{1}{2}$ in.; area 254,57 in.; contents 381,85 in.

2. What will be the solid contents of a ball, whose diameter is 7 inches, and circumference 22 inches? *Ans.* $179\frac{1}{2}$ in.

3. What is the diameter of a globe, whose solid contents are 905 inches?

Operation. $905 \div ,5236 = 1728$ the cube of the diameter.

Therefore, $\sqrt[3]{1728} = 12$ the answer.

4. The diameter of the earth is about 8000 miles, and its circumference about 25000; how many square miles does its surface contain, and how many cubic miles in solidity? *Ans.* Superficial area, 200,000,000. Solid contents, 266,666,666,666.

5. If the diameter of the moon be 2180 miles, what is its circumference, its superficial area in square miles, and solid contents in cubic miles; also, how many such globes would be equal in magnitude to the earth? *Ans.* Its circumference $6851\frac{1}{2}$ miles; superficial area 14,936,114 $\frac{1}{2}$ miles; solid contents 5,426,788,190 $\frac{1}{11}$ miles; it would require 49+ such globes.

ARTICLE XII. TO MEASURE ANY IRREGULAR BODY.

Q. By what **RULE** can you measure any irregular body, whose dimensions cannot be taken in the common way?

A. Put the irregular body into any regular vessel, either square or round, and put in water till the body is entirely covered. Measure from the top of the vessel to the water, and note the distance. Then take out the body, and measure again from the top of the vessel to the water; subtract the first measurement from the second, and the difference will be the fall of the water. Next find the area of the vessel, use proper rule of its figure; multiply this area by the fall of the water, and you will have the solidity of the body required.

EXAMPLES.

1. An irregular body, being put into a vessel 18 inches long, and 12 inches broad, when taken out, the water sank 6 inches; what were the solid contents of the body?

Ans. $18 \times 12 \times 6 = 1296$ inches.

2. An irregular body, being placed in a round tub, 18 inches in diameter, covered with water, on being taken out, it was found that the water had fallen $7\frac{1}{2}$ inches; what were the contents of the body in cubic inches?

Ans. 1908,522 inches.

MISCELLANEOUS QUESTIONS IN MENSURATION.

1. How many feet of boards will it take to enclose 1000 cubic feet of merchandize in boxes, measuring 4 feet in length, 2 feet in breadth, and 1 foot deep?

Ans. 3500 feet.

2. What is the difference in cubic feet, between a solid body of 12 feet cube, and two solid bodies of 6 feet cube?

Ans. 1296 feet, difference.

3. How many feet of boards will it take to make 100 boxes, each 4 feet cube; and how many feet to make the same number of boxes, 8 feet long, 4 feet wide, and 2 feet deep; and what will be the difference in price at \$1,75 cts. per hundred feet, for the boards?

Ans. { For 100 cubic boxes 4 feet square, 9600 ft. of boards.
 { For 100 boxes of 8, 4 and 2 ft. 11200 ft. of boards.
 { Difference in price of boards, 28 dollars.

4. Says a steady old farmer to a conceited young student, who was boasting of his great knowledge in mathematics and mensuration, can you tell how many solid inches are contained in that thorn bush? (pointing to a very gnarled and scragged bush near by.) No, says the student; to measure that would be impossible. Then, says the farmer, I will convince you that, with all your learning, I know more, at least about some things, than you do. Upon which he proceeded to cut up the bush in such a manner as to immerse it in a large water trough, measuring 8 feet in length, and two feet in width. The bush being taken out, the water fell $7\frac{1}{2}$ inches. Now, says the farmer, I have reduced the bush to a solid of 8 feet long, 2 feet wide, and $7\frac{1}{2}$ inches thick; please to tell me the contents in inches yourself.

Ans. 18144 in. or

5. A farmer borrowed of his neighbor, a solid measuring 20 feet cube. The farmer returned each measuring 10 feet cube, thinking he had wish you to inform me, what proportion of the er has paid?

Ans.

6. Suppose two large wheels, one of 14 feet in diameter, and the other 7 feet, were placed on the opposite ends of an axle, at the distance of 28 feet from each other, and put in motion upon a smooth plain; what would be the circumference and diameter of the circles, that each would describe, and what would be the area of each circle; also, how many times would each wheel turn in forming the circle? *Ans.* The larger circumference 352 ft. The diameter of the circle 112 ft. The smaller circumference 176 ft. And the shorter diameter 56 ft. Area of the larger circle 9856 ft. Area of the smaller circle 2464 ft. Each wheel will turn 8 times.

7. Six men bought a large grindstone 84 inches in diameter; how many inches of its diameter must each one grind off to get his proper share of the stone, if one first grind his share, and then the other, allowing 6 inches diameter for the eye, to be deducted?

RULE.—Square the diameter of the stone, and subtract the square of 6, for the eye, from the whole square. Then divide the remainder by the number of owners, and subtract the quotient from the dividend, and extract the square root of this last remainder, which shows the length of the diameter, after the first man has ground his share, which subtract from the whole diameter, and you will have the number of inches to be ground off, by the first owner. Thus continue the same process for each owner. *Ans.* A's diameter, 7,515. B's, 8,075. C's, 9,164. D's, 10,873. E's, 14,168. F's, 34,205, including the eye.

8. Allowing the national debt of England to be eight hundred million pounds sterling, and a cubic inch of silver to be worth 2 pounds sterling, and the whole, cast into a cubic block, what would be its cubic sides; also, if cast into a sphere or globe, what would be its diameter: if cast into a square bar, one foot square, what would be its length: and if coined into dollars, allowing 64 dollars to cover a square foot, what area of ground would it all cover? *Ans.* In a block, its cubed sides 61,44-feet. Its spherical diameter, 76,18 feet, very nearly. Square bar, 231481,481 feet, or 43,844-miles. Will cover an area of 1275,384-acres.

9. If a wheel, 6 feet in diameter, be placed on one end of an axle, and another wheel, 4 feet in diameter, be placed on the other end, at the distance of 12 ft. from the first, what length of axle must be added from the smaller wheel to enter an upright wheel from the surface of the ground? *Ans.* 15 ft. *PROBLEM.*—The frustum of a pyramid, the base diameter is 12 ft., the top diameter 4 ft., and its perpendicular height 28 ft.; what would be its area when carried to a complete cone? *Ans.* 126 ft.

MENSURATION APPLIED TO MEASURING LUMBER AND ARTIFICERS WORK.

ARTICLE I. OF MEASURING LUMBER.

Q. What is included under the head of Lumber ?

A. All kinds of joists, planks, boards, shingles, laths, clap-boards, &c.

Q. How are all joists, planks, and boards measured ?

A. They are measured by the superficial foot, or board measure.

Q. What is to be understood by board measure ?

A. Boards are measured by the square foot, at a fixed thickness ; that is, 12 inches in length, 12 inches in breadth, and one inch thick, make a foot, board measure.

Q. What is the RULE for measuring a board, whose length and breadth are given, and whose thickness is one inch ?

A. Multiply the length by the breadth, according to the rule of cross multiplication, and the product will be the answer.

Q. When the length of boards, plank, or other timber is given in feet, and the breadth and thickness in inches, how do you find the square feet ?

A. Multiply the length in feet, by the breadth in inches, and that product by the thickness, then divide the last product by 12, and the quotient will be the answer in square feet.

Q. When the length, breadth, and thickness, are all given in inches, how do you find the square feet ?

A. Multiply the length, breadth, and thickness together, and divide the product by 144, and the quotient will be the square feet.

Q. If a board or plank be wider at one end, than it is at the other, how can you measure it ?

A. Add the width of the two ends together, multiply this sum into the length, and half the product will be the answer.

Q. If a board or plank be of irregular width, how can you find the measurement of it ?

A. Take the width, at an equal number of places, both of the widest and narrowest parts, say at 2, 4, or 6 places, as may be thought necessary, and add these several widths together, then divide the sum by the number of measurements, ¹ taken, and the quotient will give the average width, which *multiply into the length, as before, and you will have the con-*

EXAMPLES.

1. How many feet in a board 13 feet, 9 inches long, and 1 foot, 7 inches in width? *Ans.* 21 ft. 9', 3".

2. How many feet in a plank, 14 ft. 8 inches long, 1 foot, 9 inches wide, and $2\frac{1}{2}$ inches thick? *Ans.* 64 ft. 2 in.

3. How many feet in a board, 14 feet in length, and 6 inches wide at one end, and 19 inches at the other? *Ans.* 14 ft. 7 in.

4. How many feet in a stock of boards, $18\frac{1}{2}$ feet in length, 15 inches wide, and 13 boards in the stock, and what must I give for them at $2\frac{1}{2}$ cents the foot? *Ans.* They measure 300 feet, $7\frac{1}{2}$ inches; I must give \$7,51 $\frac{1}{2}$ cents.

5. How many feet in 3 sticks of timber, 31 feet, 9 inches long, and measuring 9 inches one way, and 7 inches the other, and what will they cost at $4\frac{1}{2}$ cents the foot? *Ans.* 500 ft. 0', 9"; cost \$22,50 $\frac{1}{2}$ cents.

6. How many square feet in a hall, measuring 45 feet, 10 inches in length, and 32 feet, 9 inches in breadth, and what number of boards, 12 feet long, and 8 inches wide, will it require to lay the floor of the room? *Ans.* Square feet in the room, 1501 ft. 0', 6"; number of boards 187 $\frac{1}{2}$.

7. How many feet in a plank of irregular breadth, measuring 19 feet in length, the width at 4 different places being 13, 11, 15, and 7 in., and $3\frac{1}{2}$ in. in thickness? *Ans.* 63 ft. 8', 9".

8. If a board be 24 feet, 6 inches, in length, how wide a strip must be taken from one side, to measure just one square yard? *Ans.* $4\frac{2}{3}$ inches.

9. There is a stick of timber 20 inches by 15, but one with a third part of the timber in it, provided it be 8 inches deep, will serve; how wide will it be? *Ans.* $12\frac{1}{2}$ inches.

ARTICLE II. OF CLAPBOARDING.

Q. How are Clapboards bought and sold?

A. By the 100 or 1000, counted, each clapboard being required to be 4 feet long, and 6 inches wide?

Q. How is the work of clapboarding estimated?

A. Clapboarding is done by the thousand, or by the day, as may be agreed upon by the parties.

Q. How can you find the number of clapboards necessary to cover the outside of a building of any given dimensions?

A. Add the length and width of the building together, and multiply the sum by two, which shows the length of the two sides; then multiply this distance or circumference by the height to be covered, and bring the product to

square inches, for a dividend; then multiply the length of the clapboard by the width that is to be laid out, and that product by 12, for a divisor, divide, and the quotient will be the number sought. Or, divide the square feet, contained in the area of the building, by the feet which one clapboard will cover, and the quotient will be the answer.

Q. How can you calculate the area of the gable ends of a building; that is, the space included between the end plates and rafters, to the peak of the roof?

A. Multiply the perpendicular height, from the plate to the peak of the roof, by half the width of the building, and the product will be the area of one end, which being doubled, gives the area of both ends.

Q. Having the width of any building and the length of the rafters given, how can you find the height of the roof?

A. Subtract the square of half the width of the building, from the square of the length of the rafter, and the square root of this remainder will be the perpendicular height of the roof.

EXAMPLES.

1. How many clapboards will cover a building, 30 feet in length, 20 feet in breadth, and 18 feet in height, and the rafters 13 feet long; the clapboards to be laid out 4 inches; and what will they cost at 25 dollars a thousand? Operation. $30 \times 20 \times 2 \times 18 = 1800$ feet, whole area of the body of the building. To find the perpendicular height of the roof, square $\frac{1}{2}$ the width $10 \times 10 = 100$; then square the rafter $13 \times 13 = 169$; then $169 - 100 = 69$, and $\sqrt{69} = 8,3$ perpendicular; therefore $8,3 \times 10 \times 2 = 166$ feet, area of the gable ends; then $1800 + 166 = 1966 \times 144 = 283104$ inches in the whole area. The length of a clapboard $48 \times 4 = 192$ in. area that one clapboard will cover, and $283104 \div 192 = 1474\frac{1}{2}$ the number of clapboards; and cost \$36,864 cents.

2. A gentleman built a house 45 feet square, the height, to be covered with clapboards, 21 feet. In the house were 2 tiers of windows, and twelve windows in a tier; those in the first tier measured 6 feet, 8', in height, the second tier 5 feet, 9'; the breadth of each, 3 feet, 5 inches. I wish to know how many square feet are contained in all the windows: and how many clapboards it will require to cover the house out 4 inches, deducting the windows, allowing for doors? Ans. 509 feet, 1', area of the windows require $2453\frac{2}{3}$ clapboards.

3. How many boards, $14\frac{1}{2}$ feet long, and 9 inches wide, will cover a building 45 feet long, 34 feet wide, and 20 feet high, allowing the boards to be feather edged, and each one to lap one inch upon the other; and what will they cost at $1\frac{1}{2}$ cents a foot? *Ans.* It will require 327 boards, nearly; measuring 3556 $\frac{1}{2}$ feet; and will cost \$62.23 cents.

ARTICLE III. OF SHINGLING.

Q. How are shingles bought and sold?

A. They are bought and sold by the thousand, but not counted.

Q. If they are not counted, what is to be understood by a thousand of shingles?

A. So many as will be equal to 500 square feet, each shingle being required to be 18 inches in length, and to average 4 inches in breadth; though the length of shingles is different in different places.

Q. By what RULE do you find the quantity of shingles necessary to cover the roof of any building of given dimensions?

A. Multiply the length of the jet, by the length of the rafters, and bring the product to square inches for a dividend; then multiply the distance the shingles are to be laid out, by 4 for a divisor; divide, and the quotient will be the number required for one side of the roof, which being doubled will give the whole number or answer.

RULE 2.—Multiply the whole number of square feet, to be covered, by the number of shingles that will lay a square foot, viz.: If they are laid out 6 inches, multiply the square feet by 6; if laid out $4\frac{1}{2}$ inches, multiply by 8; if laid out 4 inches, multiply by 9; and if laid out 3 inches, multiply by 12; because, in each case, those are the numbers that will lay a square foot.

EXAMPLES.

1. A man built a barn, 46 feet long, and 36 feet wide, and measured 20 feet from the sills to the jet; the length of the jet, 47 feet, and the length of the rafters 24 feet. On one side feet high, and $4\frac{1}{2}$ feet wide; on the other side, 18 feet high, and 12 feet wide. How will it take to cover the whole building, all, and to make the doors; and what will it the foot? Also, how many shingles will

cover the whole building, deducting the doors, laying them out 6 inches, on the body of the building, and those on the roof to be laid out $4\frac{1}{2}$ inches, and what will they cost at 4½ dollars a thousand?

Ans. It will require of boards, 6107,32 feet. Amount \$91,609 m. Will require of shingles, 39157,9. Amount \$166,421+m.

2. How many shingles must I buy, to cover the roof of a building whose jet is 36 feet in length, and the rafters $18\frac{1}{2}$ feet, shingles to be laid out 4 inches; and what will they cost at \$3,25 the thousand?

Operation. $36 \times 18\frac{1}{2} \times 9 \times 2 = 11988$ shingles. Will cost \$38,96. *Ans.*

3. A man built a double house, 68 feet long, and 42 feet wide, measuring 28 feet from the sills to the jet. The length of the jet, 71 feet, and the rafters 27 feet, making the perpendicular height of the roof, 17 feet. In the lower story, are 2 front doors, measuring 8 by $4\frac{1}{2}$ feet; and 2 back doors, 7 feet, by 3 feet, 9 inches. There are 3 tiers of windows; in the first tier are 16, in the second are 20 windows, measuring $6\frac{1}{2}$ feet in height, and 20 windows in the third tier, 5 feet, 9 inches, in height, all of which are 3 feet, 8 inches, broad. There are, also, 2 windows in each gable end, measuring 3 feet, 9 in. in height, and 3 feet wide. It is required to know, how many feet of boards will cover the whole building; how many clapboards will cover the body of the building, being laid out 4 inches; also, how many shingles will cover the roof, being laid out 4 inches?

Ans. It will require of boards, 9258 feet, 10 inches. It will require of clapboards, 4068½. It will require of shingles, 34506.

4. One of the Egyptian pyramids is 655 feet square at the base, and its slant height 517 feet; how many shingles would cover the whole pyramid, if they were laid out 6 inches?

Ans. 4,063,620 shingles.

NOTE.—Multiply the circumference of the base, by the slant height, and half the product will be the superficial area.

ARTICLE IV. OF LATHING AND PLASTERING.

Q. How are Laths estimated in buying and selling?

A. They are bought by the thousand, counted.

Q. How is the work of Lathing and Plastering estimated?

A. It is estimated by the square yard.

Q. What is the **RULE** for measuring the plastering of a room, where doors and windows are to be deducted?

A. Find the superficial contents of the room, as you find the measurement of a building for clapboarding or shingling, and deduct one half of the openings, or contents of the doors and windows.

Q. Why do you not deduct the whole of the openings?

A. Because, the extra work of finishing around the windows and doors, is considered, by masons, equal to the plastering of one half the openings; therefore, one half only is deducted.

Q. When the room is plastered over head, how do you measure it?

A. Multiply the length by the breadth, and add this area to the area of the sides or walls.

EXAMPLES.

1. How many square feet of plastering in a room measuring 24 feet, 6 inches in length, and 15 feet, 9 inches in breadth, and 12 feet high. In the room are 3 doors, measuring 8 by 4 feet, and 6 windows, $5\frac{1}{2}$ by $3\frac{1}{2}$ feet; and what will be the cost, at 25 cents the square yard? *Ans.* 860 ft. 3 in. and will cost \$23,89 $\frac{1}{2}$.

2. What will it cost to plaster a room, 40 feet long, 28 feet wide, and 13 feet high, and plaster it overhead, at 28 cents the square yard; and how many casks of lime will it require, allowing 60 yards of plastering to a cask of lime? *Ans.* It will cost \$89,64 $\frac{3}{4}$ cents; and will require $5\frac{1}{2}$ casks of lime.

3. There is a meeting-house built of rough stone, 120 feet in length, 80 feet in width, and the walls 35 feet in height, to be plastered on the outside; what will be the whole expense, at 35 cents the square yard; and how many casks of lime will it require, allowing 45 square yards to a cask of lime, and making no deductions for doors and windows? *Ans.* It will cost \$544,44 $\frac{1}{2}$; and will require $34\frac{1}{2}$ casks of lime.

4. What will it cost to plaster a church, built of rough stone, 75 feet in length, 50 feet in width, and the wall 28 feet high, allowing \$2 $\frac{1}{2}$ a cask for the lime, and 45 square yards to a cask, and paying 12 $\frac{1}{2}$ cents a yard for the work of laying on the plastering upon the outside; for the walls on the inside, and overhead, 60 yards to the cask to be allowed, and 10 cents the yard paid for laying it on?

Ans. Laying the plastering outside \$97,222 m. Laying the
ering inside \$119,444 m. $37\frac{1}{2}$ casks of lime, $2\frac{1}{2}$ = \$93.
o amountt \$309,666 m.

ARTICLE V. OF BRICK AND STONE WORK.

Q. How are Paving, and rough Building Stone estimated, in buying and selling?

A. They are estimated by the cord of 30 cubic feet.

Q. How are hewn stone estimated?

A. They are estimated by the number of square feet contained in the hewn sides and ends.

Q. How are bricks bought and sold?

A. By the thousand, counted.

Q. What is the lawful size of bricks?

A. They are required to be 8 inches long, 4 inches wide, and 2 inches thick; though the common bricks fall a little short of those dimensions, measuring about 7 inches long, $3\frac{1}{2}$ wide, and 2 inches thick. Besides, the different qualities of bricks vary in size, in different places.

Q. What is the RULE for ascertaining the number of bricks necessary to carry up the walls of a building of any given dimensions?

A. Add the length and breadth of the building together, and from this sum subtract twice the thickness of the wall; then multiply this remainder by 2, which will give the length of the 4 sides, or walls of the building; multiply this length by the height of the wall, and this last product by 144, and you will have the square inches in the whole surface of the wall. Next multiply the length of the bricks by their thickness, for a divisor; divide the square inches in the whole wall by this divisor, multiply the quotient by the number of bricks contained in the thickness of the wall, and this last product will be the number required.

NOTE.—Bricks, of the common size, are calculated to lay 10 to the square foot. Therefore, you need only multiply the superficial feet by 10, and that product by the number contained in the thickness of the wall, and you will have the number required.

EXAMPLES.

1. A cord of paving stone is calculated to pave 9 square yards. At that rate, what will it cost to pave a street, one mile in length, and 40 feet in width, paying for the stone \$1 ⁰⁰/₁₀₀ the cord, and 12 ¹/₂ cents the square yard, for laying the
ment?

Ans. \$6192,584

2. A gentleman built a house 45 feet in length, and 34 feet in width, and 12 from the foundation to the plates; the walls faced with brick, measuring 8 inches long, 4 wide, and 2 inches thick; the rest of the wall was of rough stone, the whole thickness of the wall being 20 inches. In the house were 2 front doors, measuring 6 by 5½ feet; and two back doors, 7 by 5 feet. In the first story were 12 windows, and in the second story 16 windows, each measuring 4 feet, 10 inches, by 3 feet, 6 inches. How many cords of stone, and how many bricks were required to carry up the walls, deducting the opening of doors and windows; and allowing \$1.25 a cord for the stone, and \$1 for laying; and \$4.50 a thousand for the bricks, and \$1.75 a thousand for laying, what did the brick, stone, and labor amount to?

Ans. It required 20,619 bricks. It required 93 cords, 15 feet, 9½ inches of stone. The materials and labor amounted to \$335.55.4.

3. How many cords of stone will it require to enclose a field, measuring 60 rods by 40, with a wall 5 feet high, and 3 feet thick at the bottom, and 15 inches thick at the top?

Ans. 1234 cords, 3 ft. 9 inches.

4. How many cords of stone will it require to carry up the walls of a building, 40 feet long, 30 feet wide, and 18 feet high, the rafters of which are 20 feet long, and the gable ends built of stone; the thickness of the walls to average 18 inches, making no deduction for doors or windows, and allowing the height of the roof to be 13½ feet; and how many shingles will cover the roof, the jet being 43 feet, and the shingles laid out 5 inches?

Ans. It will require 140 cords, 14½ ft. Will require 12384 shingles.

5. A gentleman has a garden, measuring 100 yards square, which he wishes to enclose by a wall, two feet thick, and 6 feet high, both sides of the wall to be faced with brick, 4 inches wide, the top of the wall also, to be covered with brick of 8 by 4 inches, and 2 inches thick; the interior of the wall to be of stone; how many bricks, and how many cords of stone, will it require to complete the wall?

Ans. 135888 bricks, and 309 cords, 1 ft. 1½ in. of stone.

6. How many bricks will pave a yard, measuring 30 yards in length, and 15 yards wide?

Ans. 18225.

7. How many bricks will it require to build the walls of a church, 120 feet long, 80 feet wide, and 35 feet high, deducting 1200 feet for doors and windows; the thickness of the wall to average 22 inches?

Ans. 894720.

MISCELLANEOUS QUESTIONS, EXERCISING THE FOREGOING RULES.

1. How many feet of boards will make a tight fence, 6 feet high, around a lot measuring 350 feet in length, and 180 feet in width? *Ans.* 6360 feet.

2. A merchant bought a package of cloths, containing 6 pieces, each piece $27\frac{1}{2}$ yards of $\frac{1}{2}$ wide, and was to pay for it after the rate of $87\frac{1}{2}$ cents the square yard; to what did it amount at that rate? *Ans.* \$108.38 cts.

3. If 14 horses eat 56 bushels of oats in 16 days, how many bushels will be sufficient for 20 horses 24 days? *Ans.* 190 bushels.

4. If 112 acres of grass can be mowed in 14 days, by 8 men, I wish to know how many men will be required to mow 9000 acres in 10 days? *Ans.* 300 men.

5. If my correspondent purchase goods on my account to the amount of \$1800, what will his commission be at $2\frac{1}{2}$ per cent? *Ans.* \$49.50.

6. What sum being put to interest for 5 years, at 6 per cent per annum, will amount to 4500 dollars? *Ans.* \$3461.538+.

7. What must be given for 50 shares of bank stock of \$100 each, if purchased at $105\frac{1}{2}$ per cent? *Ans.* \$5275.

8. A merchant sold a quantity of goods for 5600 dollars, by which he gained 12 per cent; what was the first cost? *Ans.* 5000 dollars.

9. A. B. and C. bought a quantity of goods, which cost them \$120; and agreed that B. should pay $\frac{1}{2}$ more than A., and that C. should pay $\frac{1}{2}$ more than B.; what must each man pay? *Ans.* A. must pay \$30; B. \$40; and C. \$50.

10. A man lent a sum of money, to receive interest for it at 6 per cent; and at the end of 5 years, received for principal and interest, \$325; what was the sum lent? *Ans.* \$250.

11. A silver-smith has 2 cups of unequal weight, with one cover to both, weighing 5 oz. If this cover be put on the smaller cup, it will be twice the weight of the larger cup; but if put on the larger cup, it will be three times as heavy as the smaller cup; what is the weight of each cup? *Ans.* The smaller 3 oz.; the larger 4 oz.

12. An army being placed in a solid square of equal rank and file, is found to have 576 men on each side; how many men in the square? *Ans.* 331776.

13. There is a cubic body, the solid contents of which is 99017 feet; what is the superficial area of one of its sides? *Ans.* 57

14. What number is that, which being increased by itself, half of itself, and 5 more, will make 30 ? *Ans.* 10.

15. If the area of a circle be 2304, what must be the side of a square to contain the same area ? *Ans.* 48.

16. A man dug a cellar 12 feet square, and 12 feet deep, at the rate of $12\frac{1}{2}$ cents the cubic yard ; what sum did he receive for his labor ? *Ans.* \$8.

17. A merchant owes to A. \$800, of which \$200 are to be paid in 3 months, \$200 in 4 months, and \$400 in 6 months; what will be the equated time for the payment of the whole at once ? *Ans.* $4\frac{1}{2}$ months.

18. What number is that, from which the square of 14 being subtracted, and the square of 12 added to the remainder, the sum will be 250 ? *Ans.* 362.

19. What number added to the cube of 21, will make the sum equal to 113 times 147 ? *Ans.* 7350.

20. A brigade of soldiers is to be formed, consisting of 364 men, into a body having 32 men in rank; how many will there be in file ? *Ans.* 12 men.

21. What number multiplied into itself, will produce ,1296, decimal ? *Ans.* ,36 decimal.

22. Allowing the earth to be 25,000 miles in circumference, and 95,000,000 of miles from the sun, how many rotations of the earth would roll itself to the sun, and how long would it be in reaching it, with one rotation in 24 hours ?

Ans. 3800 rotations. 10 years, 150 days.

23. Allowing the sun to be 95,000,000 of miles from the centre of the earth, and supposing it, (as was formerly believed,) to revolve round the earth in 24 hours, what would be the circumference of the circle described by its revolution ; how many square miles would be contained in its area, and how many miles must it traverse in a minute ?

Ans. The circumference 597,142,857 miles. Its area will be 28,352,940,000,000 miles. It must traverse 414,682 miles, omitting fractions.

24. Says A. to B., if I had 4 of your sheep, I should then have as many as you would ; and says B. to A., if I had 4 of your sheep, I should then have twice as many as you ; how many sheep had each ?

Ans. A. 20. B. 28.

25. A man had his money trunk robbed, three nights in succession ; the first night, one half of his money, and half a dollar over, was taken ; the second night, half the remainder half a dollar over was taken ; and the third night, one

and half a dollar over was taken, at which
but \$20 in the trunk ; how many dollars

Ans. \$187.

26. How many yards of domestic cotton, at 14 cents the yard, must be given for 75 yards of broadcloth, at \$2,50, and 45 yards of cassimere, at \$1,75 a yard? *Ans.* 1901 $\frac{1}{2}$.

27. The two diameters of an ellipsis or oval, are 18 and 24 inches; what is the superficial area? *Ans.* 339,3 in. nearly.

28. A grocer bought 5 pipes of wine, containing 136, 128, 118, 131, and 135 gallons, at \$1,62 $\frac{1}{2}$ a gallon; after taking out 25 gallons for his own use, he wishes to make 50 dollars on the sale of the residue; how must he sell it a gallon?

Ans. \$1,77 $\frac{1}{2}$.

29. If a wheel, 6 inches in diameter, be placed on one end of an axle, 9 inches from another wheel, 5 inches in diameter, and are both set in motion on a smooth floor, what will be the diameter of the circle described by each, as they roll round on the floor?

Ans. Circle described by the large wheel, 108 inches Circle described by the small wheel, 90 inches.

30. A man owes me a note of \$387, which will be due in 4 months and 20 days, but he is willing to pay it now, if I will deduct 7 per cent, per annum, which I agree to do; what deduction must I make on the note, and what amount must I receive?

Ans. I must deduct \$10,53 $\frac{1}{2}$. I must receive \$376,46 $\frac{1}{2}$.

31. If I buy 5000 lbs. of coffee, at 12 $\frac{1}{2}$ cents a pound, what must the whole bring me, so that I may gain 12 $\frac{1}{2}$ per cent on the purchase?

Ans. \$703,12 $\frac{1}{2}$.

32. What is the difference, in acres, between 6 miles square, and 6 square miles?

Ans. 19200 acres.

33. What is the difference between 6 dozen dozen, and half a dozen dozen?

Ans. 792.

34. How many more cubic feet are contained in a cubic box, measuring 6 feet on every side, than are contained in six cubic boxes, measuring 3 feet on every side?

Ans. 54 feet.

35. How many marble slabs, of one foot wide, and 4 inches thick, can be sawed from a block of marble 4 feet wide, and 3 feet thick, allowing no waste in sawing?

Ans. 36 slabs.

36. A farmer has a large piece of meadow, which has always required 8 men to mow it in 6 days; but wishes, this year, to have it all mowed in 2 days; how many men must he employ?

Ans. 24 men.

37. What is the difference between the sum of the squares of 36 and 48, and the square of their sum?

Ans. 3456.

38. If a pipe 1 $\frac{1}{2}$ inch in diameter will empty a cistern in 3 hours, what must be the diameter of another pipe, to fill the cistern in the same time, if, when the cistern is empty, pipes be opened at the same time?

Ans. 1,7 $\frac{1}{2}$

272 MENSURATION OF ARTIFICERS WORK.

The following questions may be solved by this *RULE*. From the square of the length of the pole, (that is, the square of the sum of the hypotenuse and perpendicular,) take the square of the base, divide the remainder by twice the length of the pole, and the quotient will be the perpendicular, or height at which it must be cut off.

40. Suppose a pole to stand in a horizontal plane 90 feet in height above the surface, at what height from the ground must it be cut off, so that the top of it may fall on a point 60 feet from the bottom of the pole, the end where it was cut off, resting on the stump or upright part? *Ans.* 25 feet.

41. There is a tree that stands perpendicular 100 feet in height, but being broken by the wind in such condition that the top reached the ground 40 feet from the root of the tree; I demand the part broken, and also the part standing? *Ans.* 58 feet broken; 42 feet standing.

42. It is required to make a cistern 18 feet square, and of such depth as to contain 25000 wine gallons; what must be the depth, and how many feet of plank will it require to make it, leaving the top uncovered? *Ans.* Depth must be 10 feet, $3\frac{1}{2}$ inches; and will require $1066\frac{1}{2}$ feet of plank.

PUBLISHERS' NOTICE.

B. CRANSTON & CO.

No. 1, Market-street, Providence,

Have just published, and offer for sale, the second edition of

AINSWORTH'S PRACTICAL MERCANTILE ARITHMETIC.

THIS work comprises nearly 300 large 18 mo. pages, and commences with a great variety of simple, practical questions, particularly adapted to the capacities of children and new beginners, and, proceeding in a regular progression of combinations, contains a greater number and variety of Practical Mercantile Problems, than any work of the kind now in use. The plain and familiar manner in which the science and practical operations of Arithmetic are here explained, render it a valuable acquisition to the teacher, who wishes to instruct *intelligibly*, and to the student who wishes to obtain a ready and comprehensive understanding of the subject.

This work has been introduced into many of the schools of Rhode-Island, Connecticut, and other parts of New-England. The steady and increasing demand for it, has induced the present publishers to offer a second edition, improved by the author by the addition of valuable Mental Exercises, and compressed into a much neater and more portable form than heretofore. The paper, binding, and typographical execution of this work, will compare with the best of the school books in market, and for the quantity of matter contained in it, it is decidedly the cheapest. No pains have been spared to render it correct and perfect, in every particular. The publishers feel confident that it only needs a thorough examination, and a comparison with other works of this description, to bring it into general use and with this conviction, they submit it to the public.

Among the numerous recommendations which have been received for the first edition, from the teachers of Providence, and from others in Massachusetts, and also from other literary gentlemen of high standing, the following will serve to show the estimation in which the work is held by those who have had an opportunity of examining it.

RECOMMENDATIONS.

From Zachariah Allen, Esq. Author of "Science of Mechanics," "Practical Tourist," &c.

PROVIDENCE, Aug. 20, 1832.

Mr. Luther Ainsworth,

DEAR SIR—Judging from a hasty examination of your work, much judicious skill has been displayed in selecting practical examples to illustrate the actual application of the rules of Arithmetic, to the business-like transactions of life. That the "Practical Mercantile Arithmetic" may meet with the success which I think it merits, is the sincere hope of

Yours, very respectfully,

Z. ALLEN.

From William Aplin, Esq. Judge of the Court of Common Pleas, and one of the Committee of Public Schools.

PROVIDENCE, Nov. 3d, 1832.

Mr. Luther Ainsworth,

DEAR SIR—Your work, entitled "Ainsworth's Practical Mercantile Arithmetic," sent to me by you sometime since, I have examined, for the most part, carefully; and am prepared to say, that in my opinion the compilation, in its happy combination of familiar explanations and illustrations, so much needed and required for youthful learners, is, as a whole, decidedly superior to any work on this science, which I have ever seen. I think it will be viewed and encouraged by the public as an improvement in this department of learning.

Yours respectfully,

WILLIAM APLIN.

v. Alexis Caswell, Professor of Mathematics.

BROWN UNIVERSITY, Oct 19, 1832.

In answer to your letter, requesting my opinion of "merits" of your Arithmetic, a copy of which

you had the kindness to hand me, permit me to say that I have not examined it in all its details. But from the slight examination which I have given it, without instituting a strict comparison between it and others, which have fallen under my notice, I have no hesitation in saying, that I consider it a valuable work. The general principles of Arithmetic, so far as I observe, are clearly and fully explained. The latter part of the work, embracing the elements of Geometry, Mensuration, &c. may be very useful to many persons, whose business requires some acquaintance with those subjects, and who have not the leisure or opportunity to study more extensive treatises.

Yours, very respectfully,

A. CASWELL.

Extract of a letter from Isaac Thurber, Esq.

PROVIDENCE, Oct. 4th, 1832.

DEAR SIR—Upon examining your Arithmetic in manuscript, and, subsequently, the first edition from the press, I consider it a work, possessing such improvements in treating upon the science of numbers, and in the illustration of the Rules of Arithmetic, as to entitle it to general reception in schools. By the method of answering such interrogations as will naturally arise in the mind of the student, he is led on, by easy gradations, to a thorough acquaintance with figures, without the embarrassment which frequently arises in the mind of the young from an obscurity of the language in which the explanations are given. Besides, the examples being drawn from mercantile, manufacturing, and mechanical business, and the various pursuits of life, are designed to render it of greater practical utility, than any publication of the kind that has fallen under my observation. I am, sir, yours, &c.

ISAAC THURBER.

From the Rev. David Pickering, one of the Committee of Public Schools.

I have examined, with considerable care and attention, "Ainsworth's Practical Mercantile Arithmetic," and after a careful examination of the work, and such comparison with other similar productions as frequent opportunities have afforded, I am satisfied that it deserves a decided preference over any other now in use; and I cannot but hope that it will shortly be introduced into the public and private schools, generally, throughout our State and country.

PROVIDENCE, Nov. 2, 1832.

DAVID PICKERING.

*The following are from respectable and experienced Teachers,
in the City of Providence.*

Mr. Ainsworth,

DEAR SIR—I have been highly gratified by the examination of your “Practical Mercantile Arithmetic.” The principles of the science are unfolded, and its practical uses explained, with great perspicuity and simplicity. I think your reasonings and illustrations are peculiarly happy and original; and therefore do not hesitate to recommend it, very highly, to every person who wishes to teach Arithmetic intelligibly.

I am, with great respect, yours, &c.

OCTOBER 9th, 1832.

ALFRED RICKARD.

I fully and cheerfully concur in the sentiments above expressed.

MOSES NOYES.

OCTOBER 15th, 1832.

I also, with pleasure, add my full and hearty concurrence in the approbation of the work, above expressed.

OCTOBER, 1832.

JOHN H. WILLARD.

Mr. Ainsworth,

DEAR SIR—From the examination that I have made of your “Practical Mercantile Arithmetic,” I deem it worthy its title. I like it chiefly on account of the novelty and practical nature of the problems; and think it equal to any other work on the same system, with which I am acquainted.

Very respectfully, yours,

OCTOBER 11th, 1832.

C. SOULE CARTEE.

Mr. Ainsworth,

SIR—Having, with much care and attention, examined your “Practical Mercantile Arithmetic,” I take pleasure in saying, that I consider it a very valuable work on that important science. It contains, I think, many improvements, and, in its practical tendency, possesses many advantages over any other Arithmetic that has come under my observation. Your method of illustrating the rules by interrogations and answers, bearing on the most important points to be explained, is well

ve the pupil a ready and comprehensive view of
d to save the teacher much perplexity and
fore cheerfully recommend it, as being partic-
s attention of teachers, and the patronage of
ally.

, 1832.

I am, sir, respectfully, yours,

JOS. B. PETTIS.

Mr. Luther Ainsworth,

DEAR SIR—I have examined your “Practical Mercantile Arithmetic,” and would recommend that others, who are engaged in the cause of education, should do the same; especially if they have any desire to encourage a work that is ~~very~~ practical, and, in many respects, well calculated to supply the deficiencies of the arithmetical text books, now in use. I will add, that I am particularly pleased with your arrangement throughout the work, and hope it may succeed according to its merits. Respectfully yours, &c. ESEK ALDRICH.

PROVIDENCE, Nov. 2d, 1833.

Mr. Ainsworth,

DEAR SIR—I have examined your Arithmetic, and am happy to say I think it well calculated to advance scholars in the practical knowledge of this important branch of education, and to aid those teachers who prefer the use of a written system, to the oral method of teaching.

Respectfully yours,

OLIVER ANGELL.

I concur with the above.

E. W. BAKER.

From Rev. Samuel J. May.

Mr. Luther Ainsworth,

I have examined your Arithmetic, and am happy to say that I consider it a valuable compend of all that arithmetical science, which men need to possess, in order to the successful transaction of the common business of life; and I deem, sir, that men need a great deal more of this science, than they generally possess. I should think the merchant and mechanic would do well to have this volume always at hand. As a school book, I know of no text book to which I should give the preference, except only Colburn's First Lessons and Sequel. I am persuaded that mental exercises in Arithmetic, ought to precede exercises upon the slate.* Your Arithmetic, however, would be of great use in a school where Colburn's system might be adopted, particularly for those pupils who are somewhat advanced. Respectfully yours,

BROOKLYN, April 30, 1834.

SAMUEL J. MAY.

* This opinion in regard to the necessity of mental exercises as a preparatory course, has become so general, that it is considered as naturally appertaining to books prepared for the instruction of youth. In accordance with this opinion, the author has added a complete course of introductory mental exercises, without deducting from the practical nature of the work.

From Rev. Luther Wright, graduate and past tutor of Yale College, now Teacher of Languages in Ellington School, Connecticut.

ELLINGTON, Oct. 10, 1832.

Mr. Ainsworth,

DEAR SIR—I have examined your Arithmetic, and do not hesitate to commend it to public patronage. Your treatise on Fractions is particularly valuable. I regard, too, that part of your work in which you have treated of Geometry, Mensuration, &c. as a very important addition to it. I cheerfully add, that in my opinion, your Arithmetic is very practical in its examples, and also, that it is an excellent one to be studied by those who are destined to mercantile and other pursuits.

Yours, with much respect and esteem,

L. WRIGHT.

From Rev. Zebulon Crocker, graduate of Yale College, Teacher of Mathematics in Ellington School.

ELLINGTON, Oct. 10, 1832.

DEAR SIR—Your Arithmetic was put into my hands, a few days since, with the request that I would examine it, and express my opinion in regard to its merits. In general, I have been pleased with your plan and its execution. Your examples are practical and copious, your rules are clear and concise, and your arrangement well ordered and judicious. On the subject of Vulgar Fractions, particularly, I think your book deserves great credit. The last pages on Geometry and Mensuration, as far as I have examined, I think a valuable addition. Every scholar designed for business, who has not the advantage of an extensive course of Mathematics, ought to be furnished with the rules for calculating superficies and solids.

Yours, truly,

ZEBULON CROCKER.

Mr Ainsworth,

SIR—I fully agree in the opinion expressed by my friends, the Rev. L. Wright, and the Rev. Z. Crocker.

Yours, &c.

SANFORD LAWTON.

Preceptor of Monsen Academy, Mass.



